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The Best METHODS of FRAMING TIMBER BUILDINGS
of all FIGURES and DIMENSIONS, with their several Parts,

As Floors; Roofs in Ledgment, their Lengths and Backings; Trussed Roofs, Spires,
and Domes; Trussing-Girders, Partitions, and Bridges, with Abutments; Centering
for Arches, Vaults, &c. cutting Stone Ceilings, Groins, &c. with their Moulds;
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With the PLAN and SECTIONS of a BARN.

Engraved on Twenty-Four PLATES, with EXPLANATIONS, forming the
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By WILLIAM PAIN, ARCHITECT and CARPENTER,
Author of the PRACTICAL BUILDER, and the
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L O N D O N,

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MDCCLXXXI.

[Price Four Shillings, bound.]

ROBERT D. HORTON

THE PATENT OFFICE, LONDON

IN THE MATTER OF THE PATENT FOR INVENTION

OF A METHOD OF IMPROVING THE CONSTRUCTION OF

THE PATENT FOR INVENTION

BY WILLIAM D. HORTON



Printed by the Stationer, London

P R E A C E.



IN the art of building, an intelligent and expert carpenter is intitled to the foremost place, or first degree of eminence; for he is able to erect a house without calling in either bricklayer or mason, neither of whom can execute the like task independent of his assistance. His profession depends on the practical application of the most plain, simple, and unerring principles; and more pleasure results from the view, as well as more comfort from the use, of a neat well constructed common house, than from the most superb but ill contrived palace; where fanciful ornaments are frequently introduced with no better intention than to disguise blemishes in proportion and symmetry. Strength and convenience are the two most essential requisites in building; the due proportion and correspondence of parts constituting a beauty that always first attracts the eye: and where that beauty is wanting, carving and gilding only excite disgust. In like manner, the affectation of gaudy dress in a man, who has the misfortune to be deformed, answers no other purpose than to invite ridicule and contempt.

Architecture being founded on geometry, a carpenter ought to qualify himself in the fundamental principles of that science; he should acquire a proper judgment of the materials he works on, both as to quality and quantity; and in the use of them, the dimensions of scantlings according to the bearings; the trussing of girders and partitions, and the dove-tailing of collars. To assist the young practitioner in these particulars applicable to common buildings on given plans and elevations, under the several articles of framing, flooring, roofing, ceiling, and arching; with the construction of bridges, groins, and spires; is the purpose of the following sheets. Every object treated of, is so circumstantially and accurately represented in the plates, that very little explanation is needful to comprehend them; the descriptions are therefore proportionably brief, to avoid confusing the mind by a multiplicity of words.—In conclusion, the intention being to concentrate every material operation in the common branches of carpentry; it is hoped nothing is omitted necessary to enable an attentive workman to become his own surveyor, and to execute whatever instructions he receives, on true principles, according to the most correct methods.

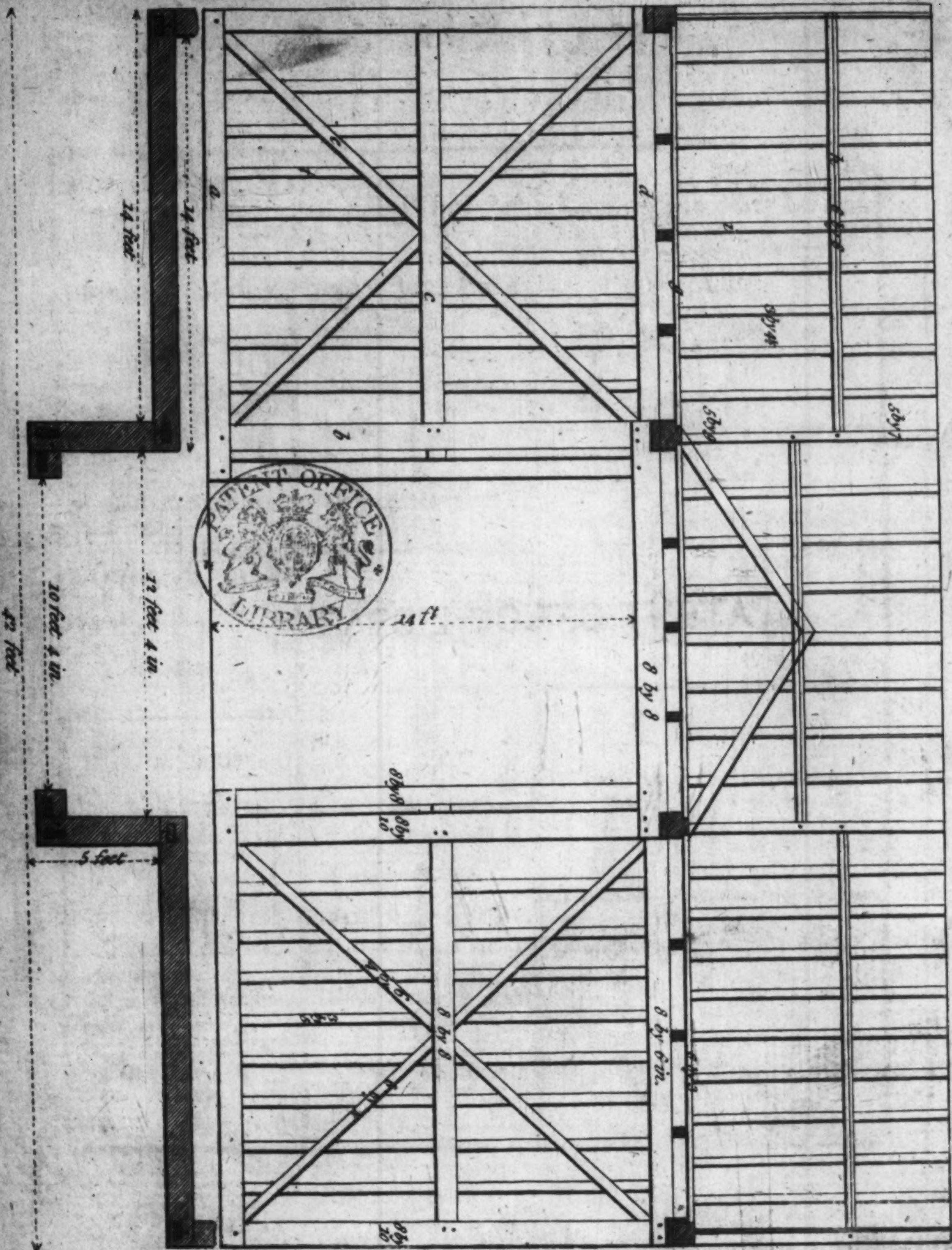
If decorations are required, the proportions of the orders, mouldings, with their enrichments, cornices, with other parts of ornamental architecture, are fully treated of, and explained, according to the present taste, in the *Practical Builder, and Carpenter and Joiner's Repository*, both by the same author.

A TABLE of SCANTLINGS for cutting Timber in proportion to different Heights and Lengths of Posts, Girders, and other bearing Timbers.

Bearing-Post.		Scantling.		Common Joists framed the Depth of the Girder.		Small Rafters.			
		Inches.				Length.	Scantling.		
If 8 ft. high		8	by 6	If bearing.		8 feet	4½ by 3		
10		8	7			10	5 3		
12		9	8			12	5½ 3½		
14		10	8	6 feet					
16		12	10	8					
				10					
				12					
				14					
Girders, if bearing.		Scantling.				Principal Rafters.			
		Inches.				Lengths.	Bottoms.	Tops.	
12 feet.		10	by 8	Beams or Tyes.		12 feet	8 by 4½	6 by 4½	
16		11	10			16	9 5	7 5½	
20		13	12			20	10 5½	8 5½	
24		14	12			24	11 6	9 6	
28		15	13			30	12 7	9 7	
32		18	16			36	12 8	10 8	
Binding Joists, if bearing.		Scantling.		Length.					
		Inches.							
6 feet		6	by 4						
8		7	4						
10		8	4½						
12		10	5						
14		12	5						
Bridging Joists, if bearing.		Scantling.		Ground Sills.		Purlines.			
		Inches.				Bearing.			Scantling.
				From 6 by 4		6 feet			6 by 6
				To 6 by 5		8			7 6
				Or 10 by 6		10			8 7
						12			9 8
Raising Plates the same as Sills.							Punchings, or upright Studs.		
				From 6 by 4			From 3 by 4		
				To 8 by 5			To 6 4		
				Or 10 by 6			Or 9 3		
							if required.		

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P L A T E I.

The Elevation and Part of the Plan of a Timber-built Barn,

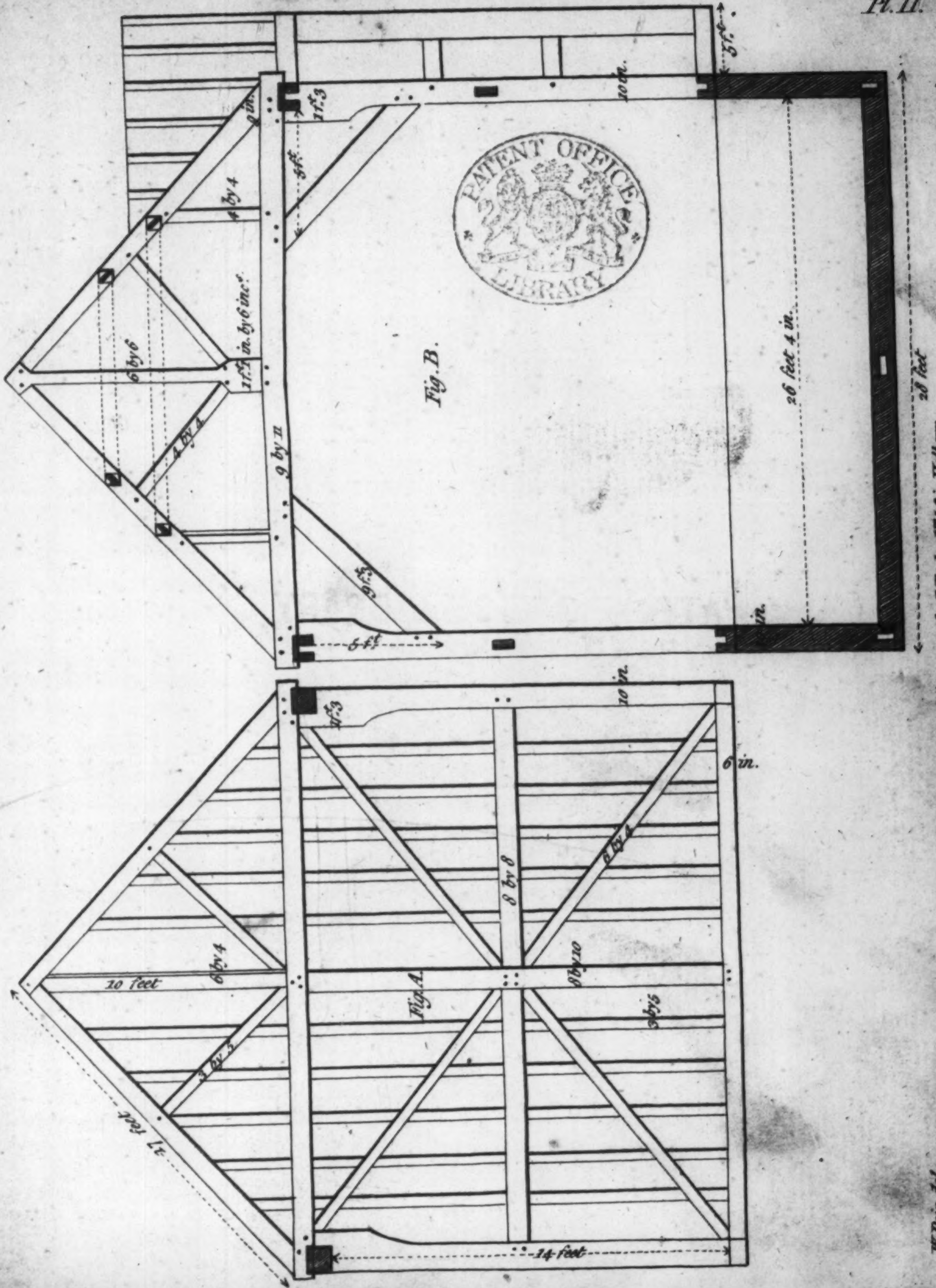
S H E W S the manner of framing the timbers together, with a porch at entrance. The measures of the timbers are all figured for the scantlings in common practice. The camber of the beams to be $1\frac{1}{2}$ inch. The whole length of the building 42 feet from out to out; and the breadth 28 feet. These scantlings will do for a building twice or three times the length, but of the same width, or not exceeding 30 feet wide.—If the building should exceed the foregoing height and width, the scantlings must be in proportion to their length and bearings, as in the table of timbers.

P L A T E II.

Fig. A is the Elevation of the End, and Fig. B the Section of the Barn, with all the Measures of the Timbers figured for Practice.

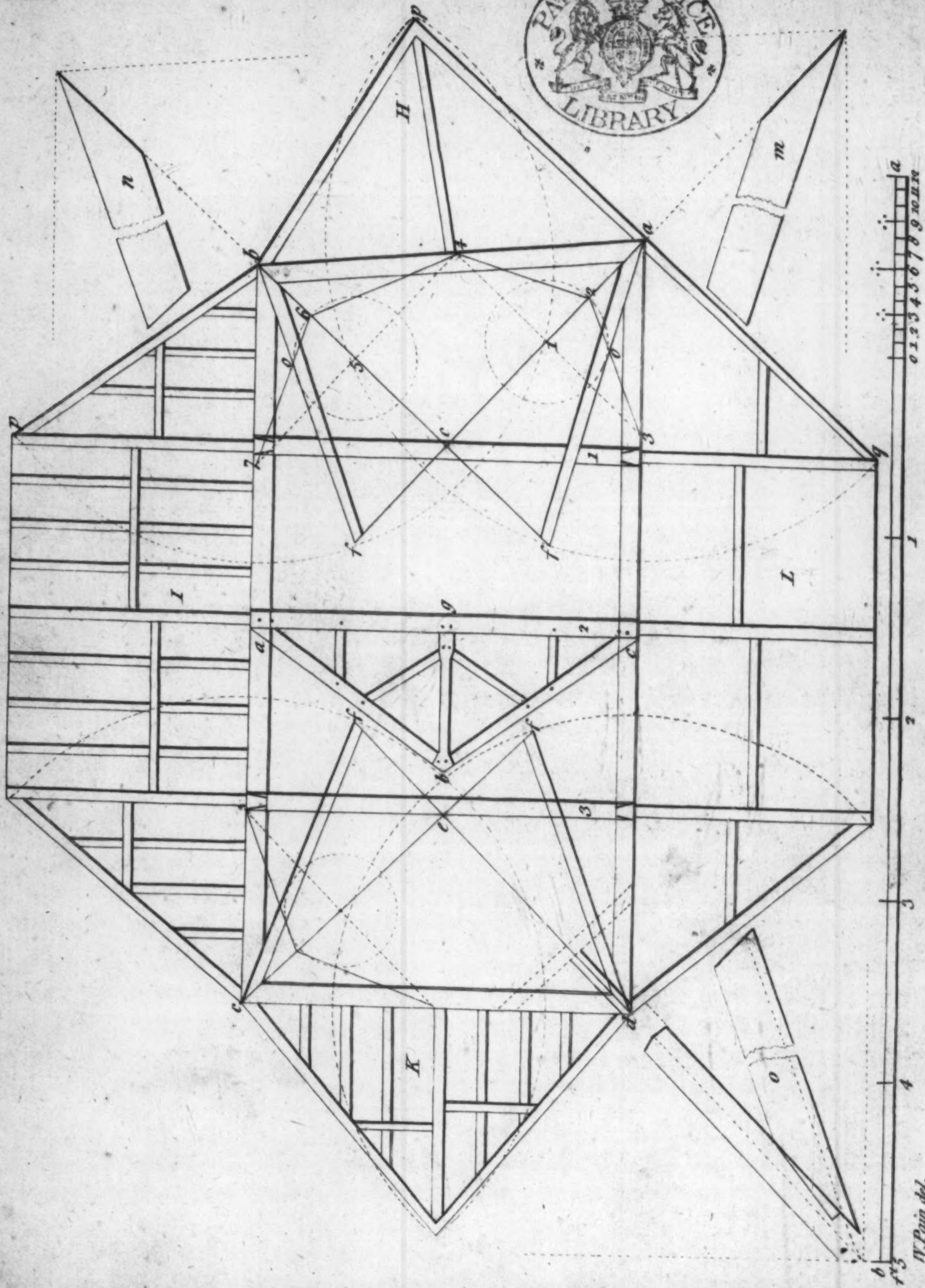
THE whole width from out to out is 28 feet, and 26 feet 4 inches within, with gable-ends for more convenient room. The dotted lines in the section of the roof represent stretching pieces to go between the purlines, to prevent them from swagging down, the bearings between the principals being near 13 feet long. As the measures are all figured, they will appear plainly on inspection. The ground-fills to be 10 inches by 6, the main post 8 inches by 10, the door post 8 inches square. The interstice in the sides, between the post, to frame the quarters or punchings in, 8 inches by 8, braces 6 inches by 4, punchings 5 inches by 3, raising plates on the top of the post 8 inches by 6, braces there from the post to the beam 9 inches by 3, tessel or top-part of the post 1 foot 3 inches by 8 inches, beam 11 inches by 5, king-post 1 foot 1 inch by 6 inches, the shaft of ditto 6 inches by 6, when the butments are cut straight to the king post; the rafters 4 by 4, the principal rafter at bottom must be 9 inches by 5, at top 7 inches by 5.

The purloins or girt pieces framed between the principal rafters to be 6 inches square, for the reception of the small rafters, and to be framed into the principal rafter horizontally, or level with the base line, as represented in the section; the small rafters 3 inches by 4 $\frac{1}{2}$.



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P L A T E III.

The Plan of a Roof in Ledgment, shewing the Method to find the Length of the Hips, Square or Bevel, and their Backing to any Pitch required.

L E T a, b, c, d , be the angles or corners of the building, to find the length of the hips and their backing.

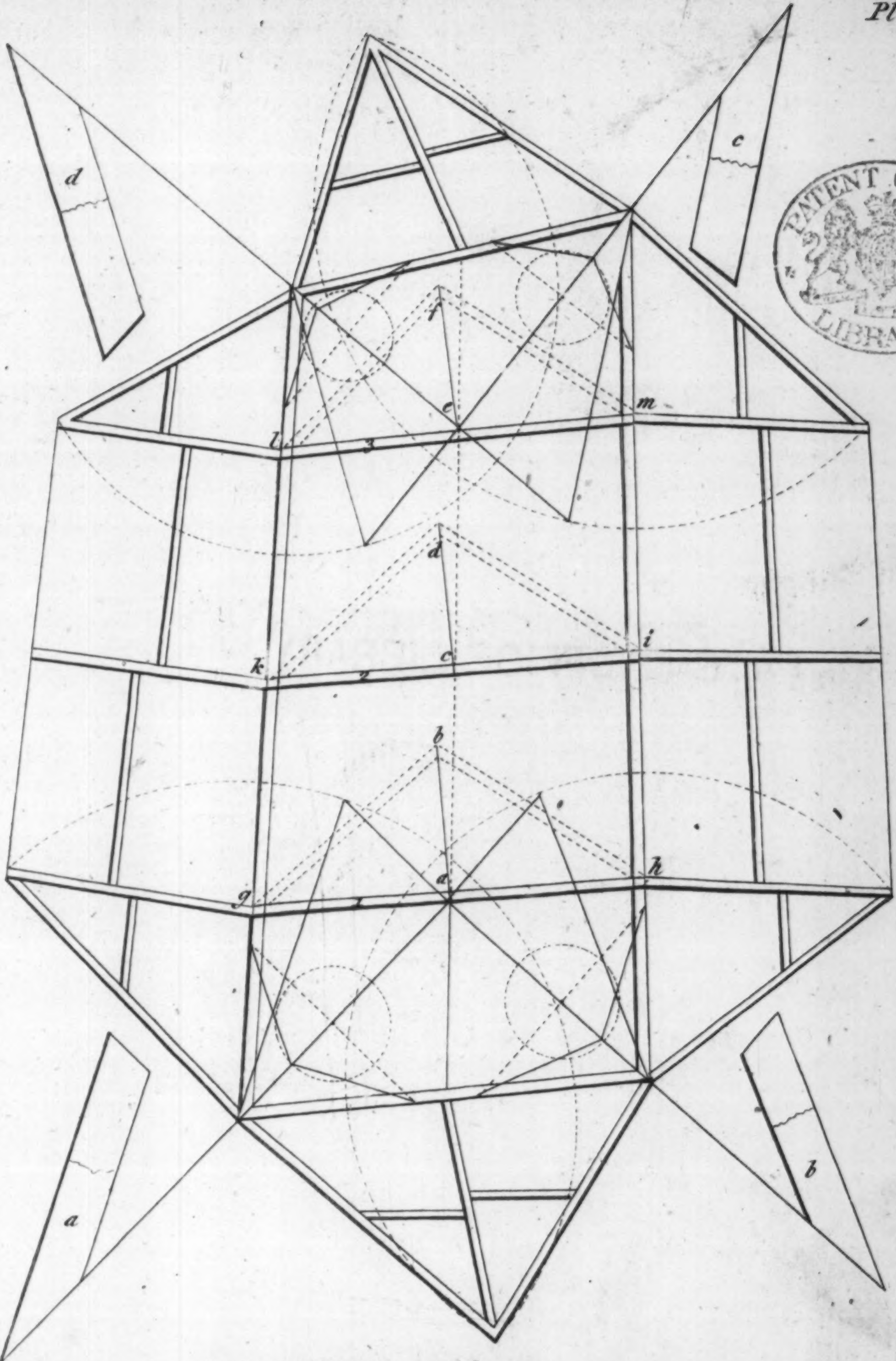
First, lay down the plan of the roof $a b c d$ to a scale of one inch to a foot, as the scale $a b$; then, according to the ground you have to build on, take your dimensions, and draw the plan: supposing the plan $a b c d$ that to be roofed in; then draw the principal rafters on the plan $a b c$, and dispose of the beams at proper distances, as room will admit, which beams, numbers 1 and 2, will stand to receive the top of the hips; then draw the base lines of the hips $a-c$, $b-c$, at the bevel-end; and at the square end draw the base lines $c-e$, $d-e$; then take the perpendicular height of the principal rafters g, b , and set it perpendicular from the base-lines of the hips $a c$, $b c$, and $c e$, $d e$, as $c f$, and $e f$; then draw the lines $a f$, $b f$, $c f$, $d f$, these lines will be the length of each hip respectively. Then, to find the backing of the hips, draw a line square with the base-lines of the hips as 4, 1, 3 and 4, 5, 7; then set the compasses at 1, and extend them to touch the hip at o , and draw the small dotted circle as there described; then from the point 2, where that circle cuts the base-line, draw these lines 2-3, 2-4, which are the backings of the hips: proceed in the same manner at the angles b, c , and d , as will appear plain to every practitioner on inspection.

H, I, K , and L , are ends and sides in ledgements; m, n, o are the bevels for the feet and tops of the hips to lay out the sides and ends. Set the compasses at the angle a , draw the dotted circle $p f q$; then set the compasses at b , draw the dotted circle $f r p$, which gives the length of the hips, and rafters laid out. This is a general method for finding the length and backings of hips in any case required, square or bevel, which will plainly appear in all the following plates. Notwithstanding the plans may be different and irregular, the method is the same in every respect.

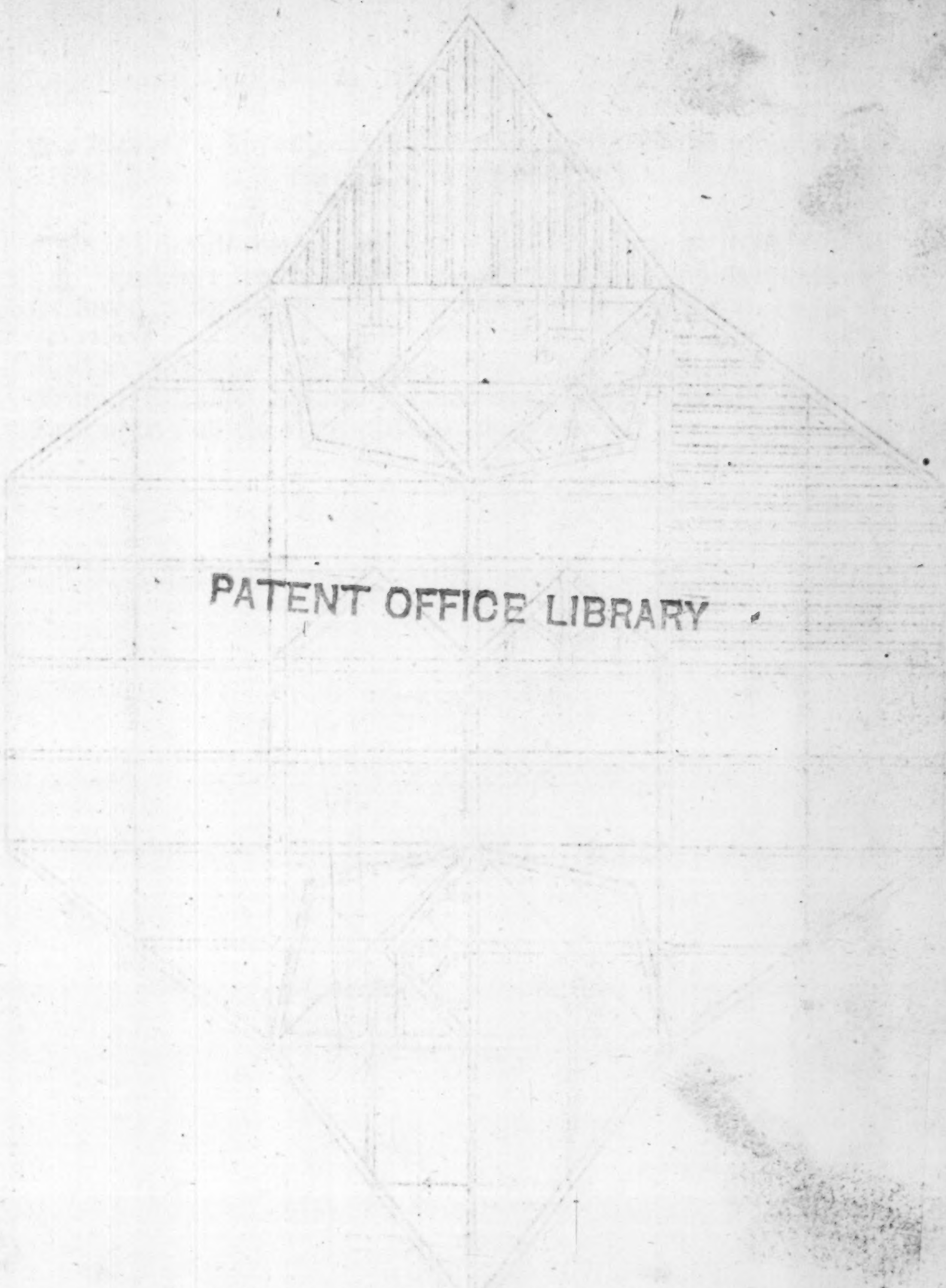
P L A T E I V.

An irregular Plan to be roofed in, Bevel all the Way.

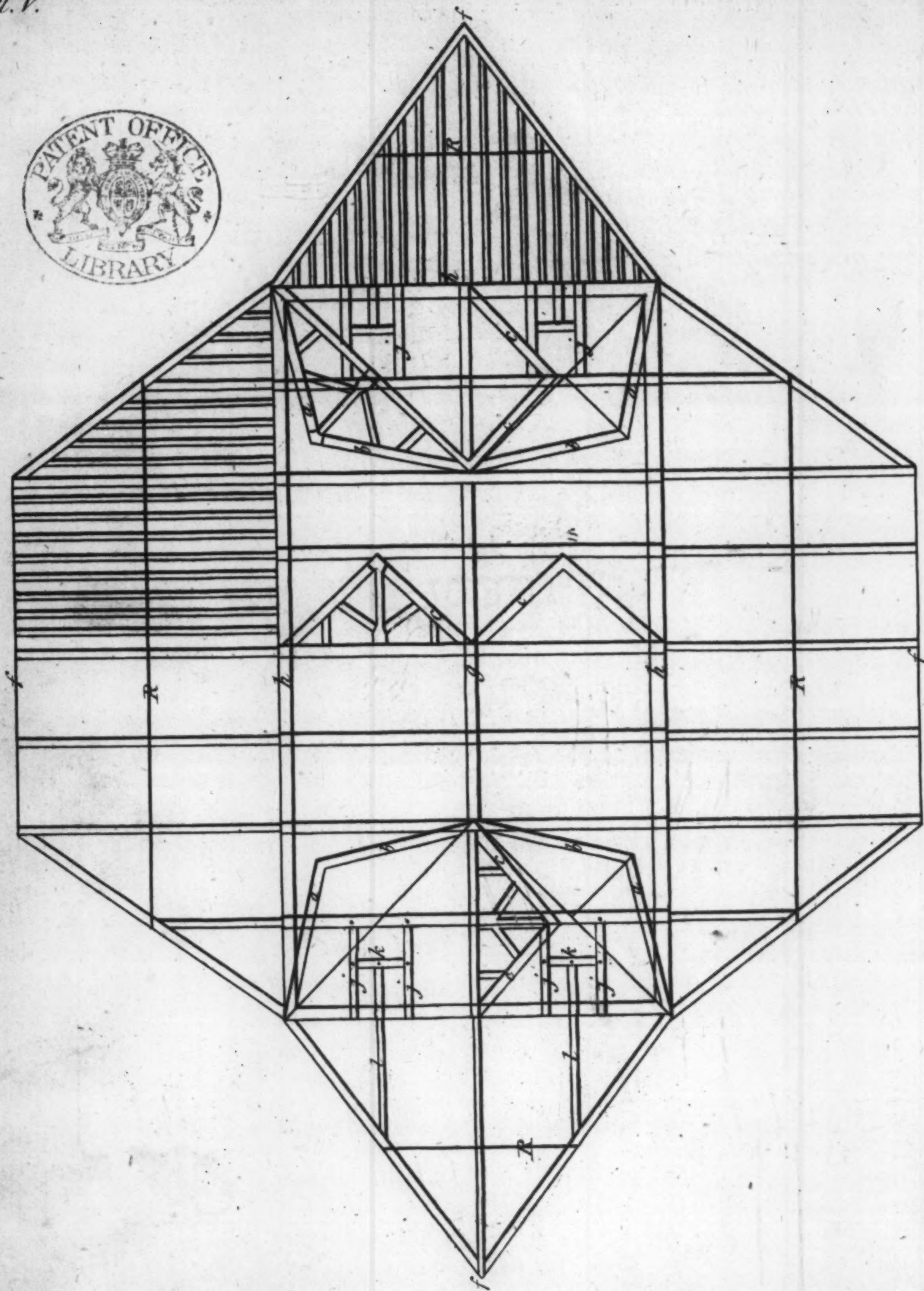
TH E method for finding the length and backing of the hips, the same as before in every respect; but the principal rafters vary by reason of the building being wider at one end than the other; so, when they are laid down in their proper places, as 1, 2, 3, you must draw perpendicular lines from the centres of the beams *a s*, *a b*, *c d*, *e f*; and those perpendicular lines must be of equal height from the base-lines or beams; then from the point *b*, draw the dotted lines *b g*, *b b*, which gives the length of the principal rafters to stand on the beam *g b*; then draw the lines *d i*, *d k*, which gives the length of the principal rafters to stand on the beam *k i*; then draw the lines *f l*, *f m*, which gives the length of the principal rafters to stand on the beam *l m*. In this plan the perpendiculars are all equal; but the lengths of the rafters are not alike, as appears by the plan; *a b*, *c d* are the bevels for the feet and tops of the hips; the sides and ends are laid out by the same rule as the foregoing, which is obvious so as to require no further explanation.



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P L A T E I V.

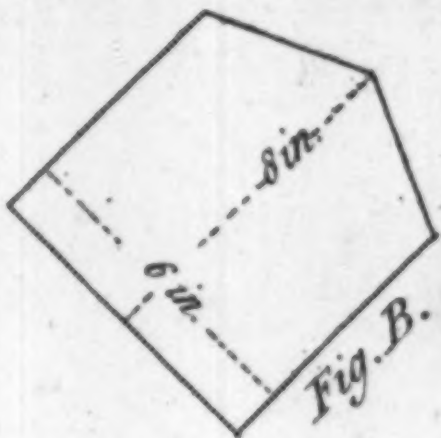
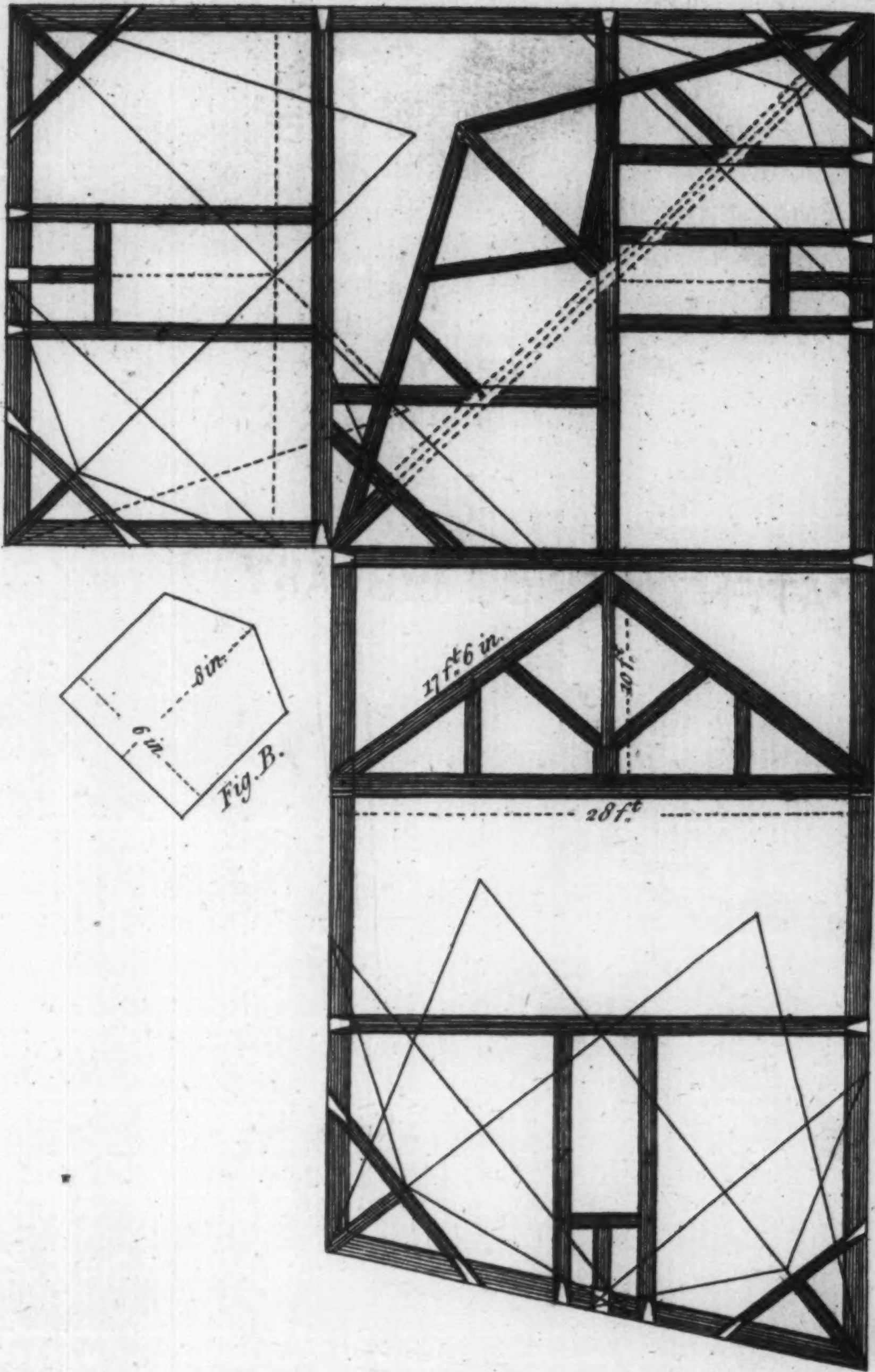
*Is a Plan of an M-roof, where a Building is too wide to span at once, a
Gutter must be in the Middle.*

THIS will require four hips and four vallies, as is plain to inspection: the lengths of the hips and vallies, and their backings are found in the same manner as before; *a a* hips, *b b* vallies, *c c* principal rafters, *R R* the ridge lines, *g* the gutter, *f* rafter-feet, which are to stand on the gutter-plate, *b* rafter-feet at the eaves *j* binding-joint, *k* the trimmer to frame into the hammer-beam for the chestal-rafters *l* to stand upon; all the rest is plain to inspection.

P L A T E VI.

A Building to be covered in, whose Plan is an L, which requires a Hip and Valley; the whole is plain to Inspection, the Timbers being all properly placed.

AS to the general heights or pitch of the roofs, they are various according to fancy; but for plain tile covering very little under a square will do; and for slate about one third of the width for the perpendicular height, &c. the width or span of the roof 28 feet, the perpendicular height 10 feet, length of rafters 17 feet 6 inches, scantlings of rafters 9 inches by 5 at bottom, 7 inches by 5 at top; king-post 1 foot 1 by 6 inches, struts 4 by 4, beams 11 by 9, hips 6 by 4; *Fig. A*, valley 6 by 8; *Fig. B*, the binding joist; 1, 2, 3, 4, 5, 6, the trimmers and hammer-beams; 7, 8 their scantlings 11 inches by 5; the length and backing of the hips are found by the same rule as in the foregoing roofs; the small rafters $4\frac{1}{2}$ inches by 3, ceiling joist $2\frac{1}{2}$ inches by 3, &c.



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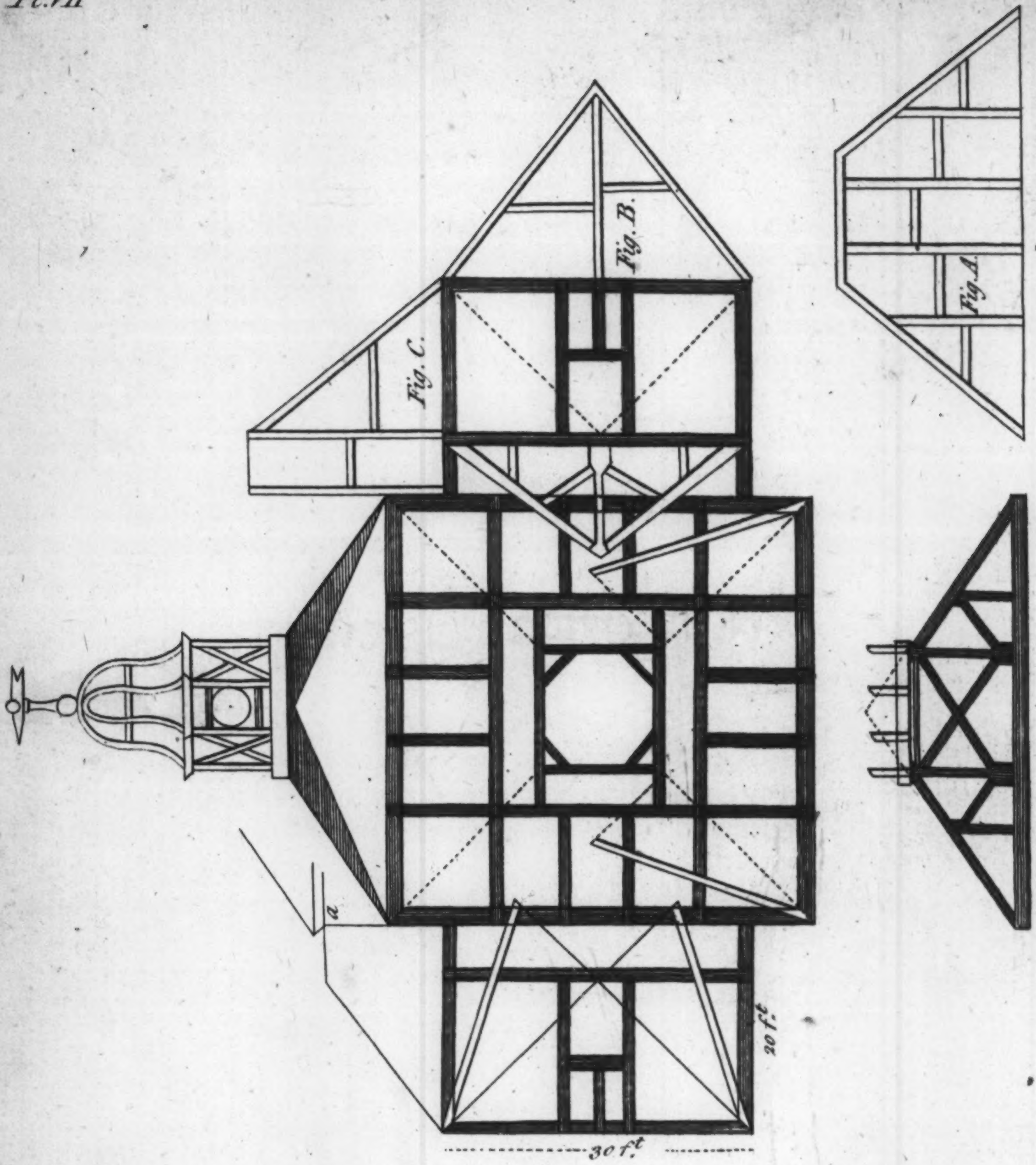
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P L A T E VII.

A square Pavilion with two Wings to be roofed in, the Top of the Ridge finishes the Roofs of the Wings under the Cornice of the Centre-building, as at a.

TH E centre-building 40 feet square, the two wings 30 feet by 20. On the centre-roof is a turret for a clock; so that the rafter has 4 feet taken from the perpendicular, which makes the principal rafters polards to support the turret; the whole length for the centre-roof would be 25 feet; but the polard rafter, as cut, is about 18 feet in length, 10 inches by 6 at bottom, 8 by 6 at top; king post 1 foot 2 inches by 7 inches; shaft of ditto 6 inches by 7, braces 6 inches by 4, hips 7 inches by 4; beams 14 inches by 12; the beams to the two wings 12 inches by 10, principal rafters 9 inches by 5 at bottom, and 7 by 5 at top; king post 13 inches by 6; braces 4 by 4; length of rafters 18 feet 6 inches, perpendicular height 11 feet. *Fig. A*, one side of the centre-roof in ledgment; *Fig. B* and *C* the side and end of one wing in ledgment; the turret has a bell-roof, which appears on inspection.

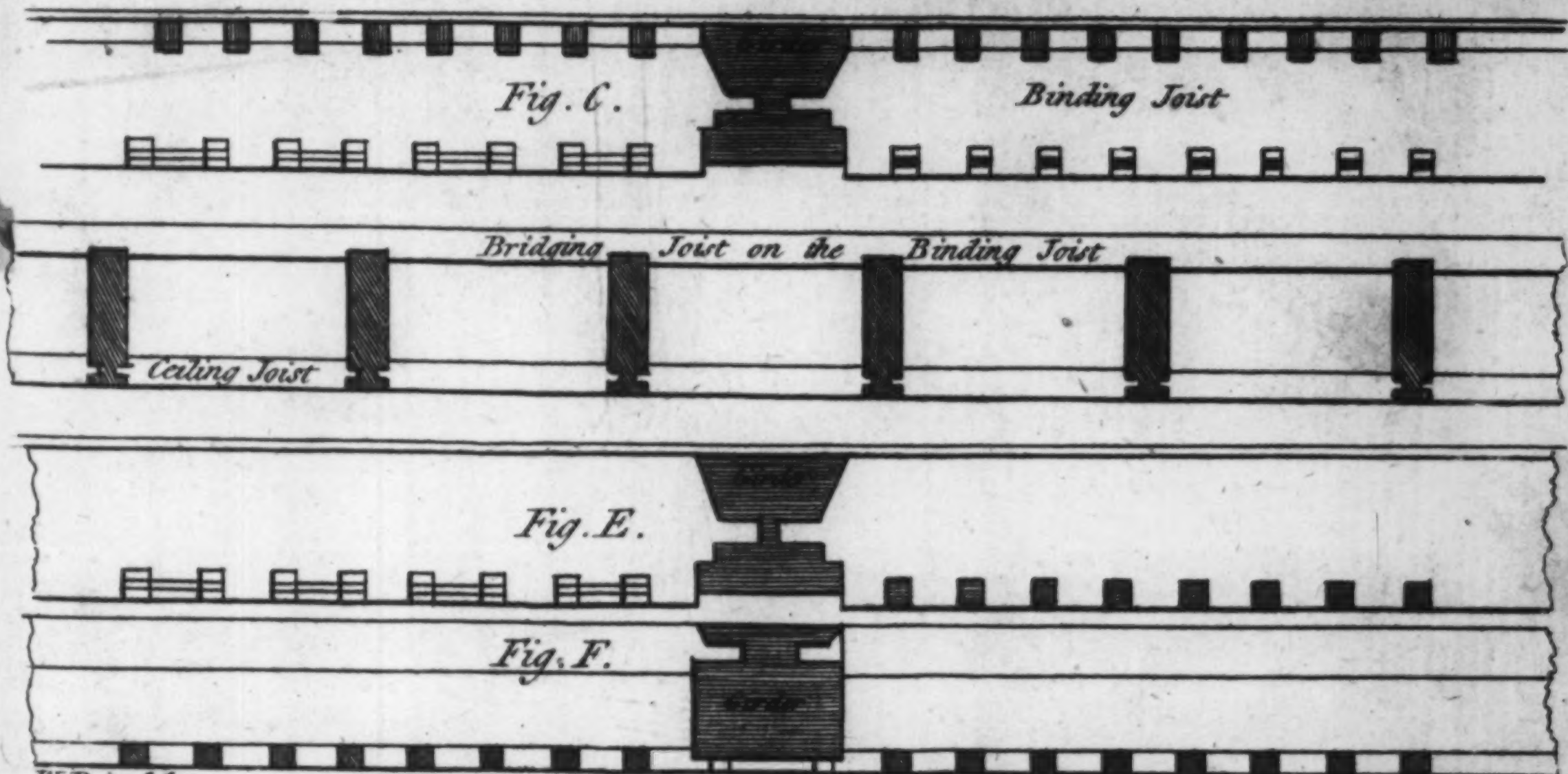
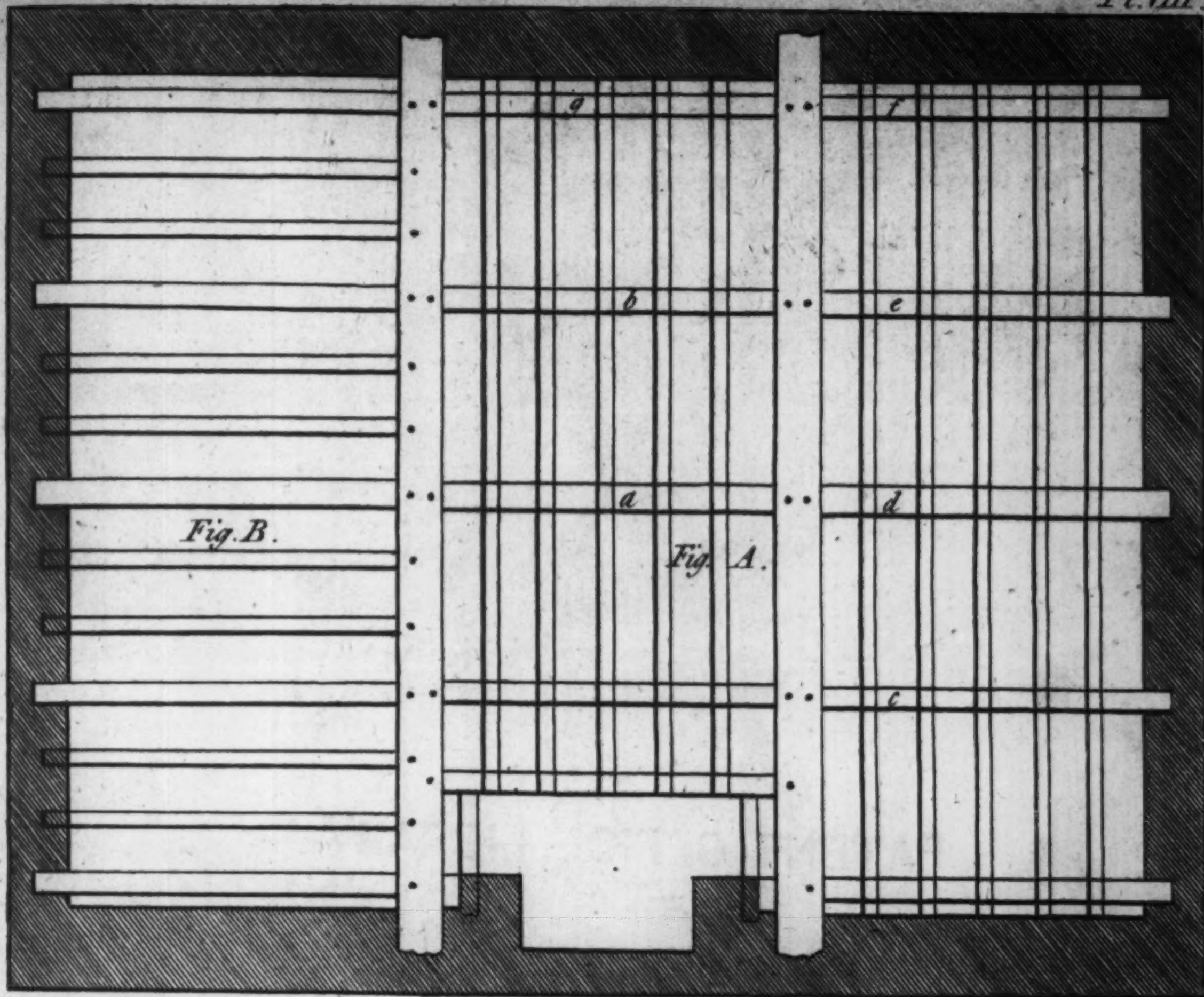
Note, The length and backing of the hips found as before, needs no further explanation.

P L A T E VIII.

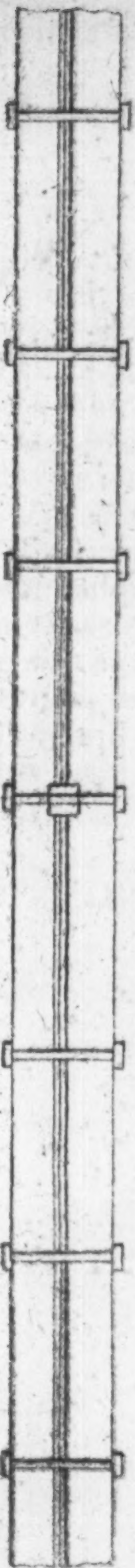
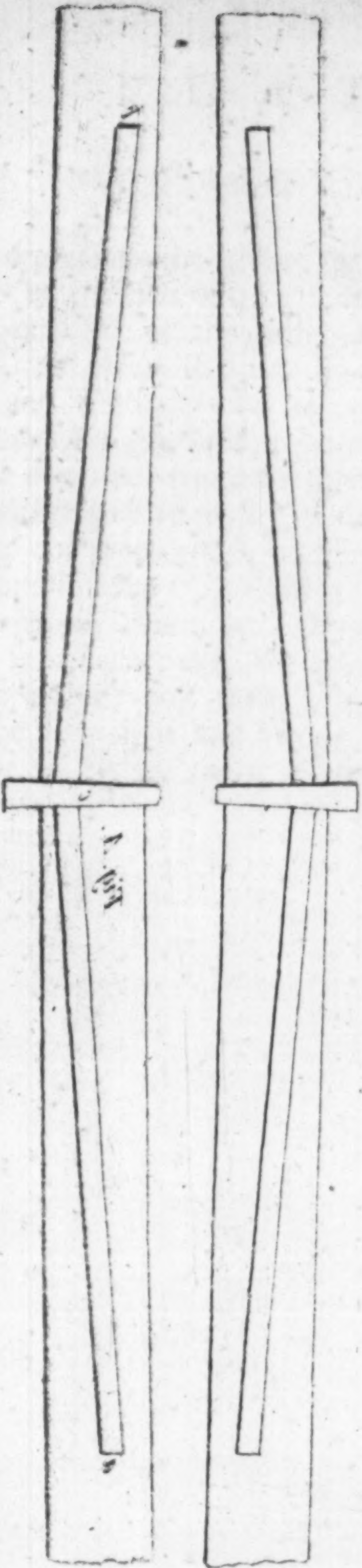
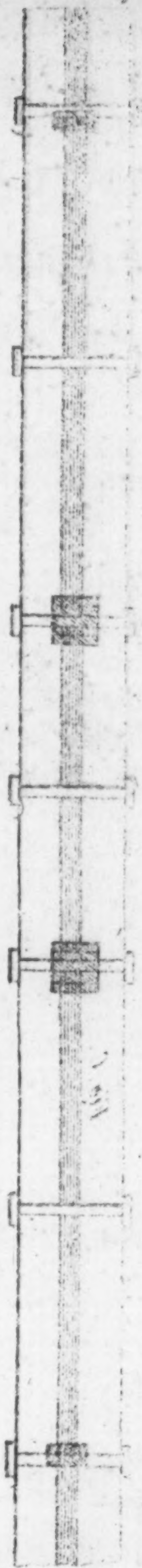
Naked Flooring.

FIG. A, is a bridge-floor; the binding joists *a, b, c, d, e, f, g, &c.* are framed into the girders about $3\frac{1}{2}$ inches below the top, and half an inch below the under-side of the girder, to receive a furring on the girder, in order to prevent the ceiling from cracking; this should be done always; the binding joists to be framed into the girders at 4 feet distance; not to exceed 5 feet. As to the depth of the binding, if the girder be a foot deep, the binding joist must be 9 inches deep, by $4\frac{1}{2}$ inches, the bridging joist 4 by 3; so that the bridging joist will notch down half an inch on the binding, and the binding will be half an inch below the girder, as in the section *Fig. C*, and the binding joist to be one side with pulley mortices for the ceiling joist, and the single mortices for ditto: if the girder be 14 inches deep, the binding joist will be 10 inches deep by 5 inches thick, the bridging joist $3\frac{1}{2}$ by 5 inches.

One side of the floor, as *Fig. B*, is framed in another manner, the binding joist framed flush with the top of the girder, being deep enough to go half an inch below, and to be morticed for the ceiling joist as before, which is plain in *Fig. E*, the section of the floor. These binding joists may be framed about 4 or 5 feet apart, so that they admit of two, or not to exceed three smaller joists between them, as represented in *Fig. F*. These sorts of floors are never more than 10 inches deep, girders sometimes 8 or 9 inches deep; so the depth of the binding joist must be half an inch below the girder, by $3\frac{1}{2}$ or 4 inches thick; ceiling joist $2\frac{1}{2}$ by three inches, &c. The small joists between the binding joists $2\frac{1}{2}$ by 5, or 3 by 5 inches; all the rest is plain on inspection.

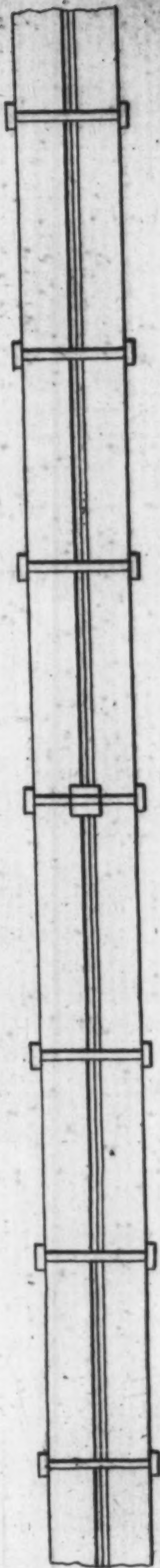
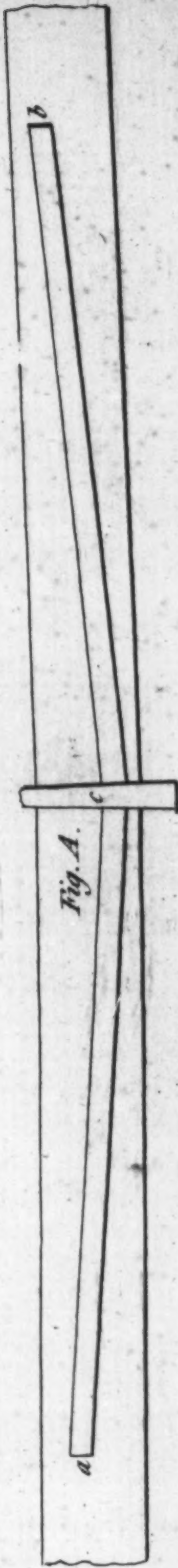
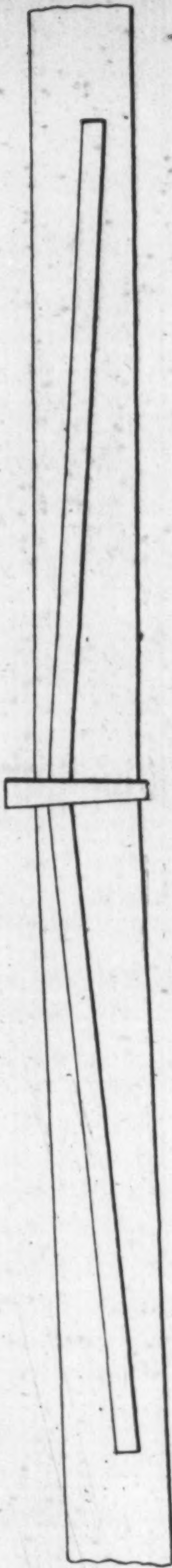
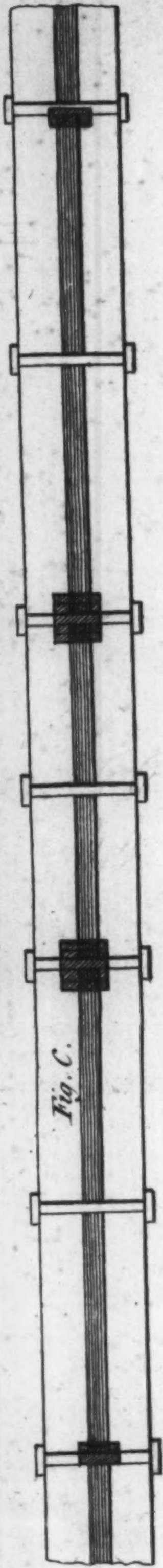
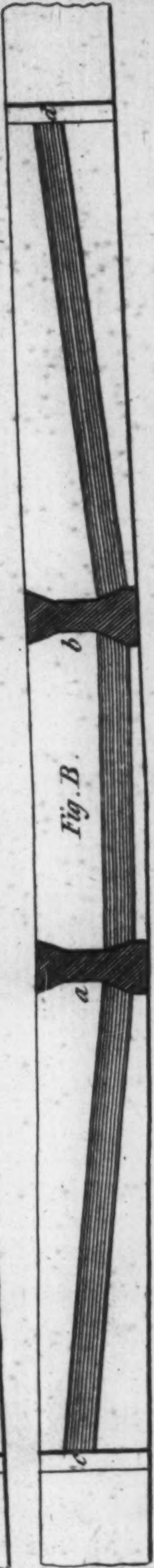


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W. Pain del.

PLATE IX.

The Manner of trussing Girders by two different Ways.

FIG. A represents the girder to be trussed; the truss to be of dry oak, about 4 inches or $4\frac{1}{2}$ square.

Let into each side of the girder about $1\frac{1}{2}$ inch, and at the butments *a* and *b* put iron plates to keep the pieces of wood from pressing into each other, and a good wedge in the centre at *c*, which will spring the girder when drove tight, and a bolt through the wedge when set with driving; the two sides are not supposed to come together by one inch.

Fig. B another way to truss a girder.

Supposing one piece not stout enough, then take two pieces of timber, and supposing the truss to be $4\frac{1}{2}$ or 5 inches square, let one inch into each piece, and have two king-pieces as *a* and *b* cut dove-tail, and let one inch into each piece, the same as the truss, and have wedges at the tail, as *c* and *d*; bolt them together, and drive the spring wedge. They will be very tight and strong, when bolted to, notwithstanding they will be 3 inches apart, as represented by the shaded part of **Fig. C**.

P L A T E X.

Trussing Girders, Partitions, &c.

FIG. A represents the girder to be trussed; the truss about 4 inches square, let in so that the sides shall nearly come together, and have two bolts at the meeting of the truss, as *a* and *b*, and wedges drove at the tail to spring the girder; when bolted together, put in iron plates for the wedges to drive against.

Fig. B is a trussed partition with screw bolts to truss it up, which is very plain to inspection.

Note, All girders should be cut camber, half an inch in ten feet, or one inch in twenty feet, and so on in proportion.

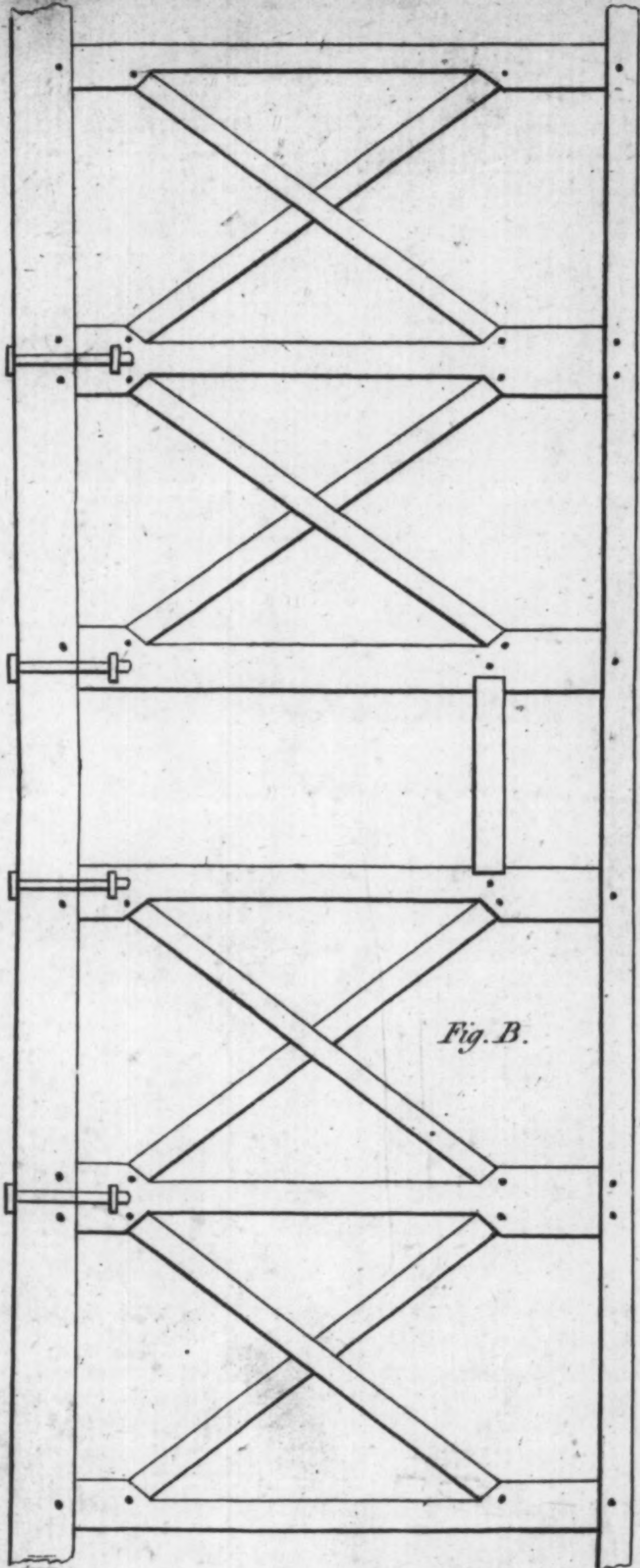


Fig. B.

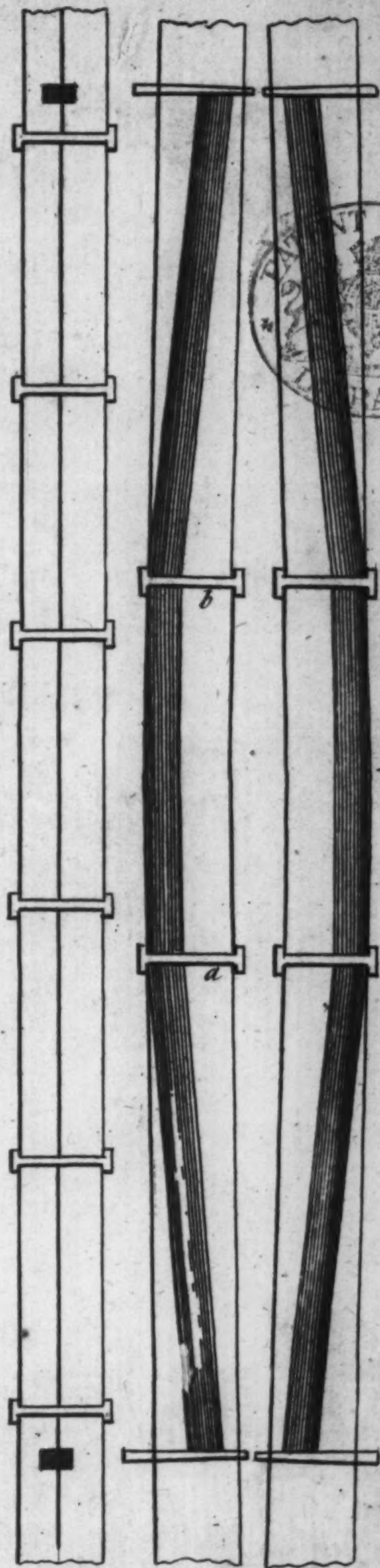
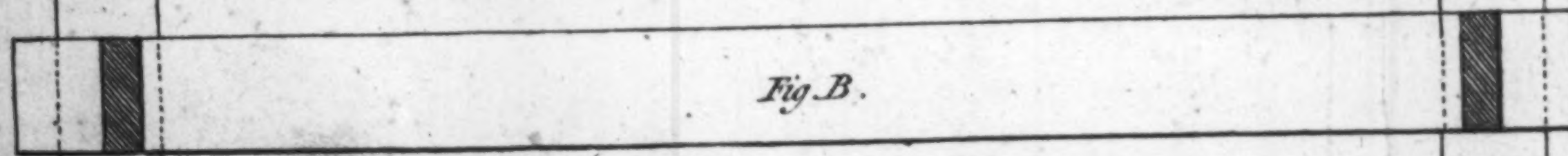
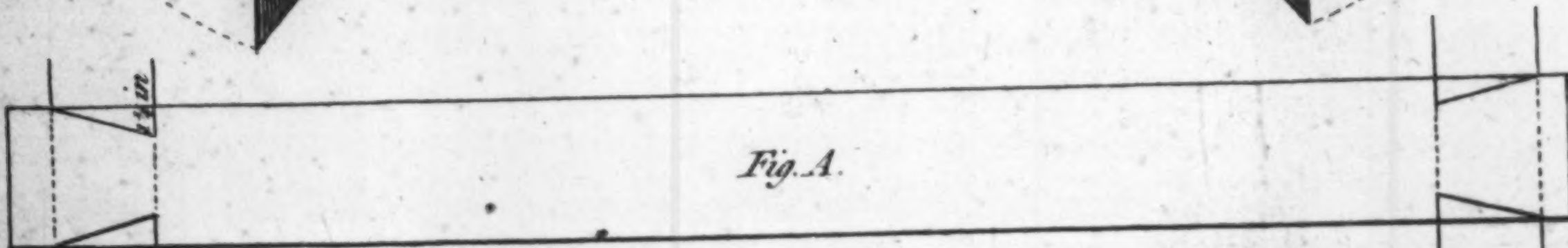
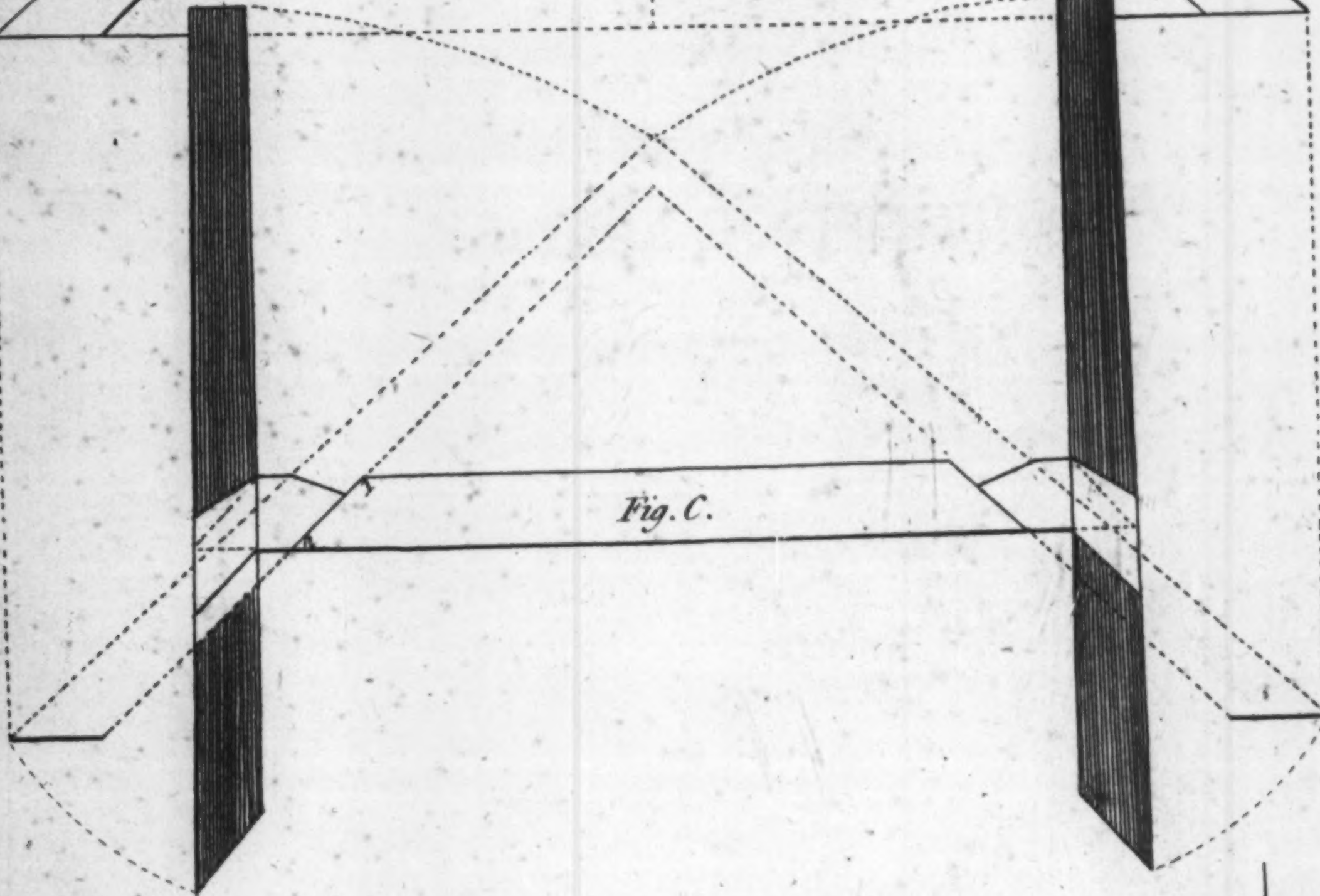
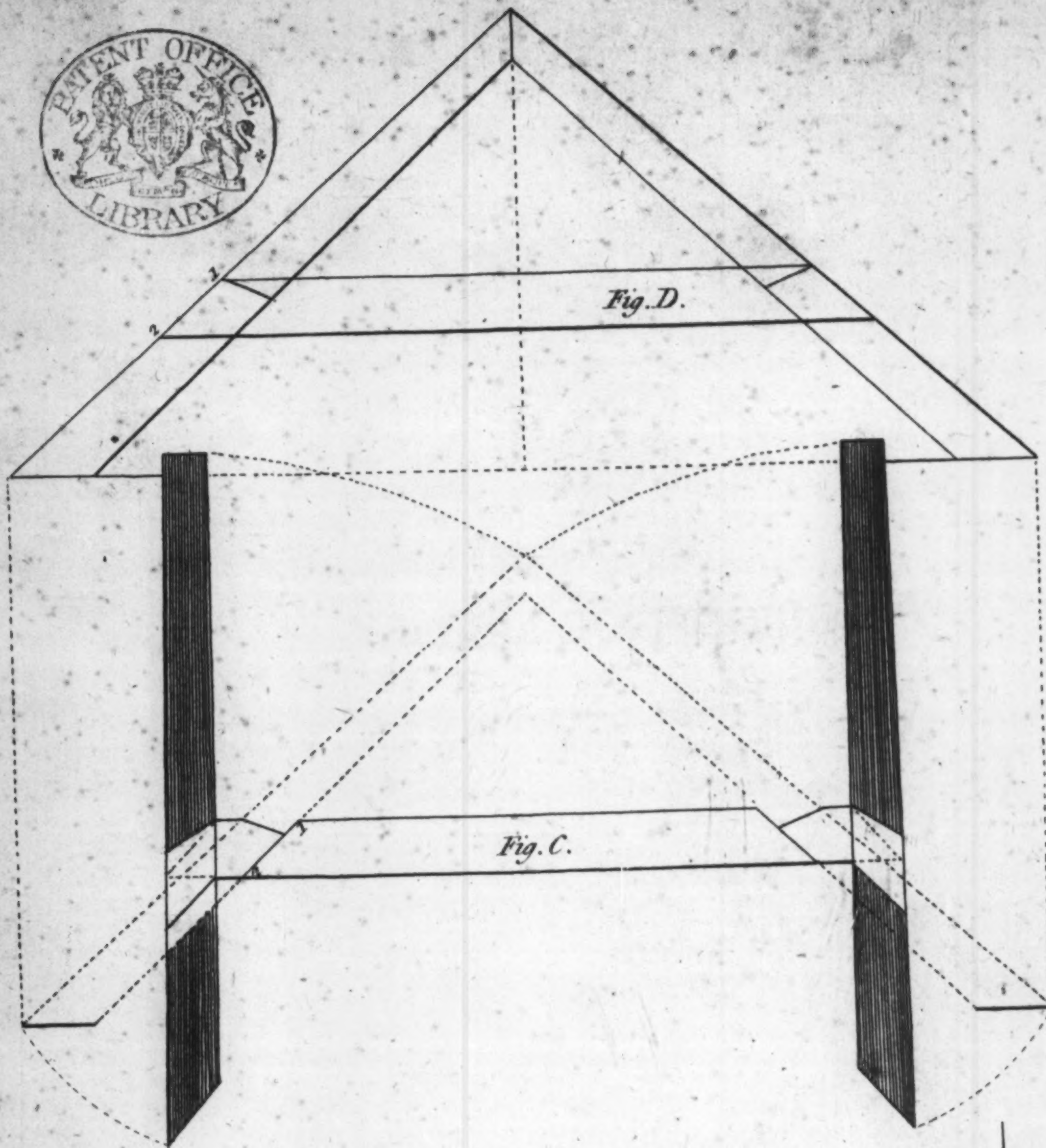


Fig. A.



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P L A T E X I.

Shews the Method of framing Dove-tail Collars.

FIG. C a collar and rafters putting together, which shews by the circular dotted lines, at top and bottom of the rafters, how they are brought together. The mortice on the inside of the rafter to be the exact width of the collar, and the outside as much as the bevel-line 1—2 the inside or outside of the collar, these when put close together will complete the work designed.

Fig. A shews the method of dove-tailing beams on raising or any place required. The dove-tail on each side the beam should not be more than one inch and quarter, and about one inch and quarter down.

Fig. B is another method of putting down beams, with an indent cut in the beam: leave as much substance in the plate as will exactly fit the indent in the beam, and the indent one inch and quarter deep. This is a very good way, for the beams never can draw out of their places.

Fig. D shews the rafters put together, &c.

P L A T E XII.

Shews Roofs and trussed Partitions.

FIG. A represents a roof with a dove-tail collar; N^o 1. is a post or ashleer framed into the girder and principal rafter; N^o 2. is the hammer beam which frames into the ashleer, and to have an indent or notch down on the wall-plate, to keep the wall from going out.

Fig. B is another roof with struts to support a running purline to bear up the small rafters; or a collar may be framed to the rafters to hold the purline, if a collar, the rafters must be all of a depth; but with struts the rafters must be notched out.

Fig. C represents a trussed partition.

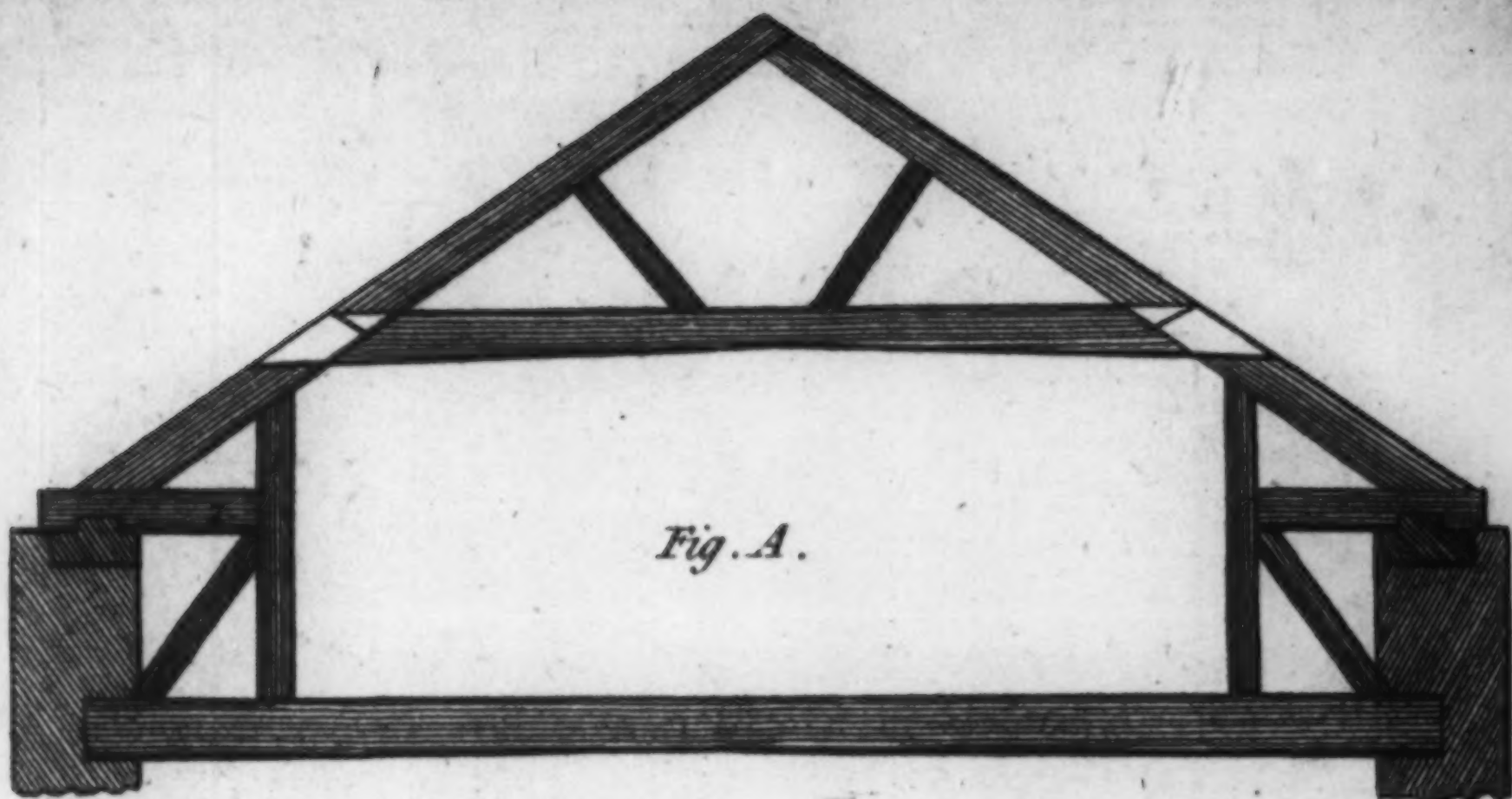


Fig. A.

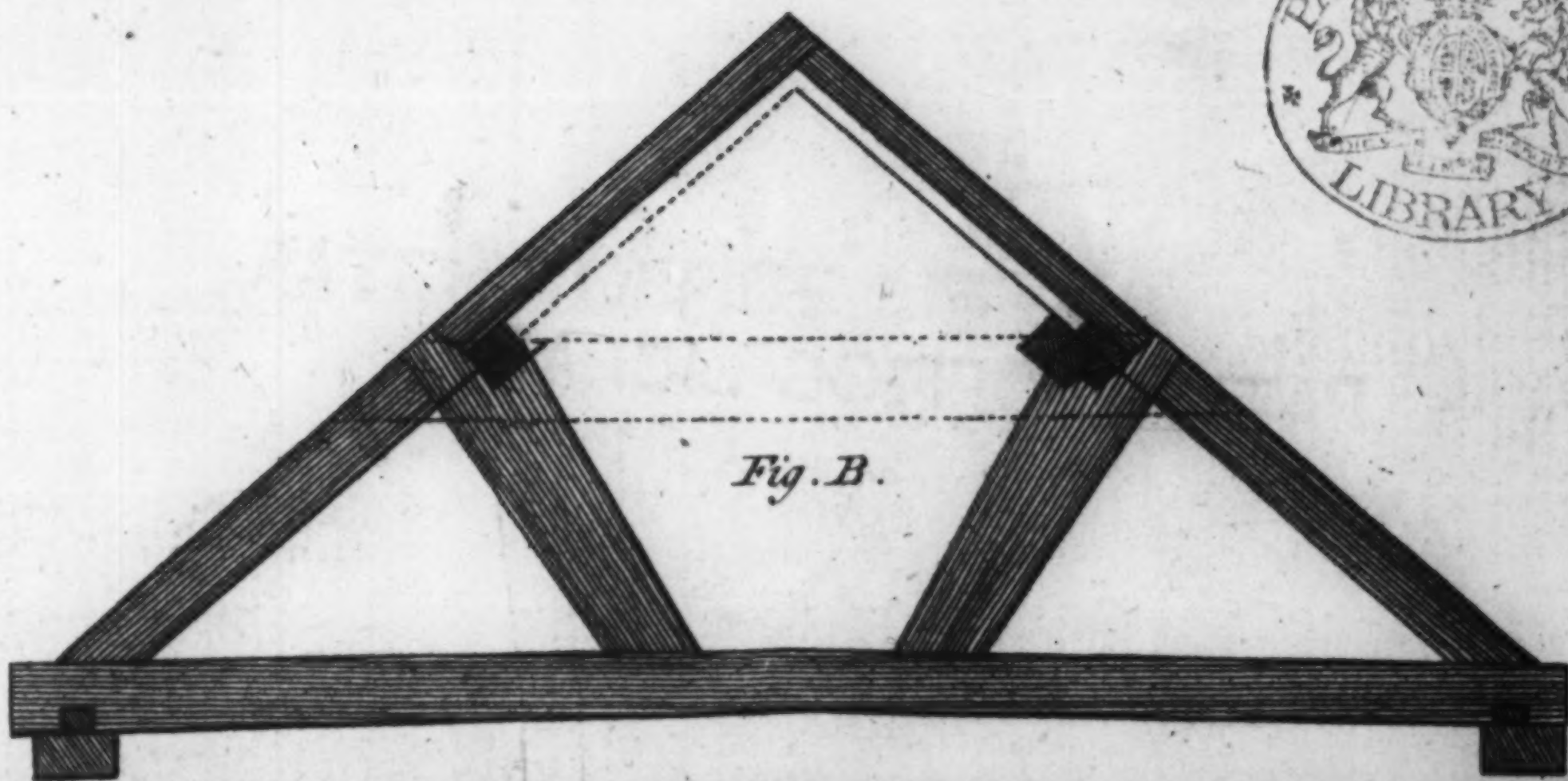


Fig. B.

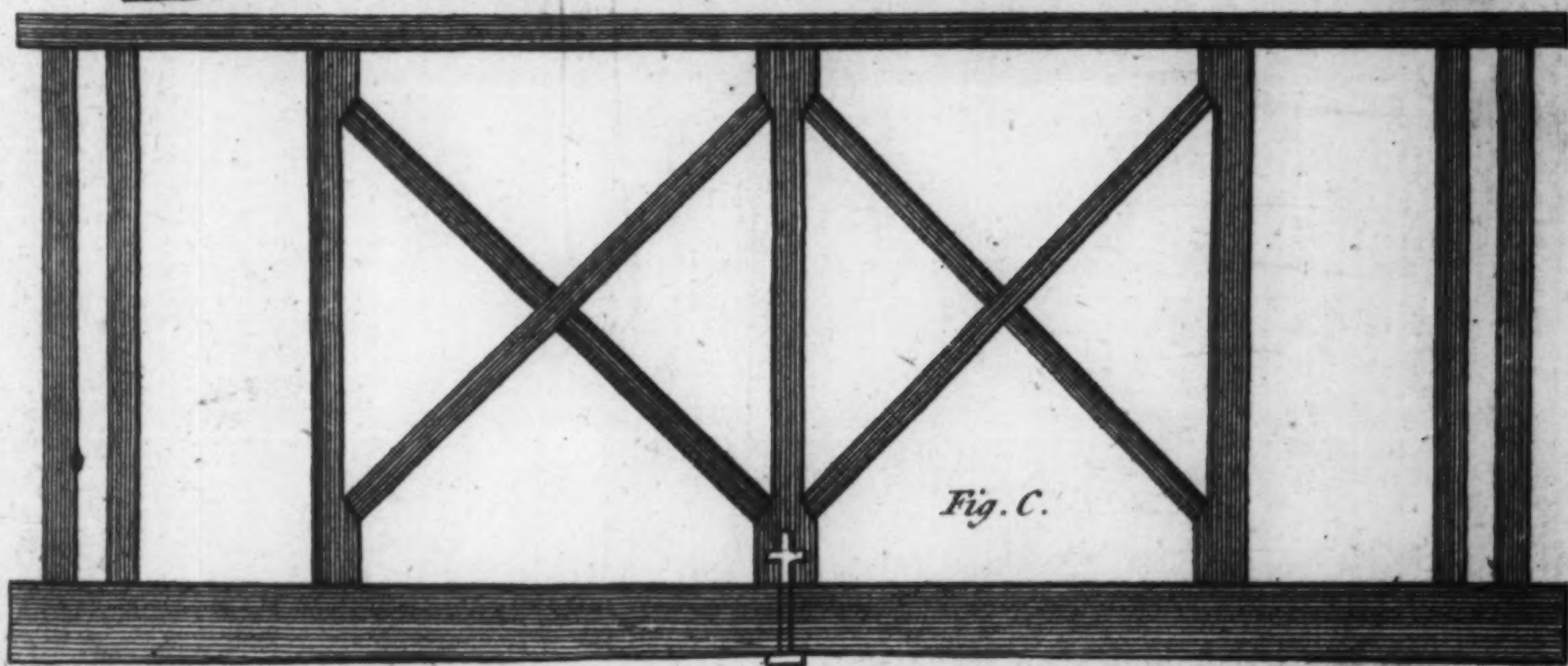


Fig. C.

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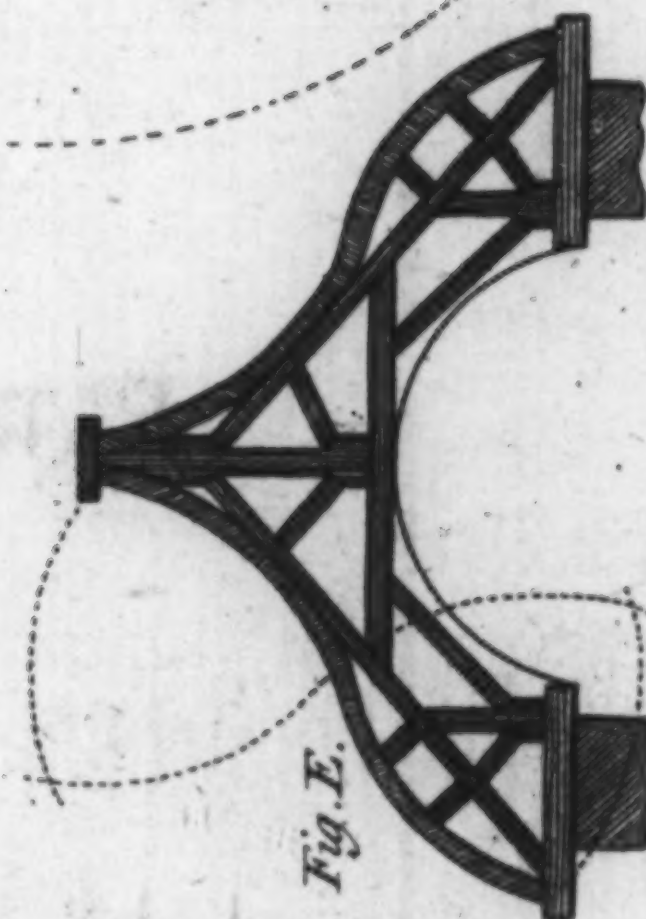
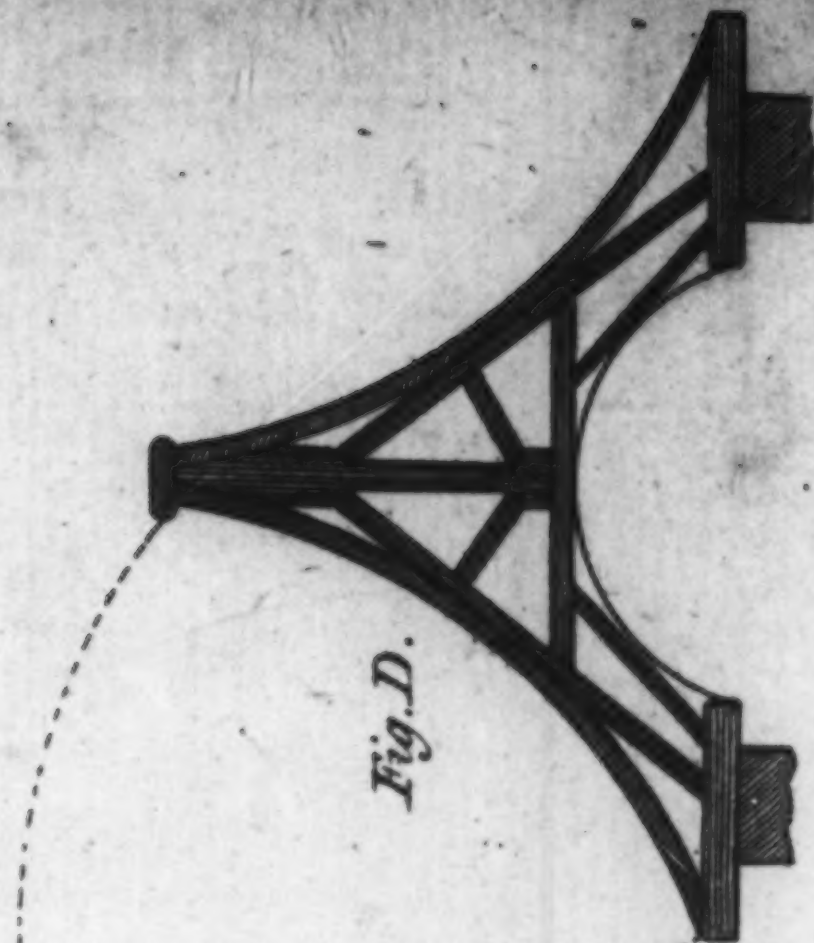
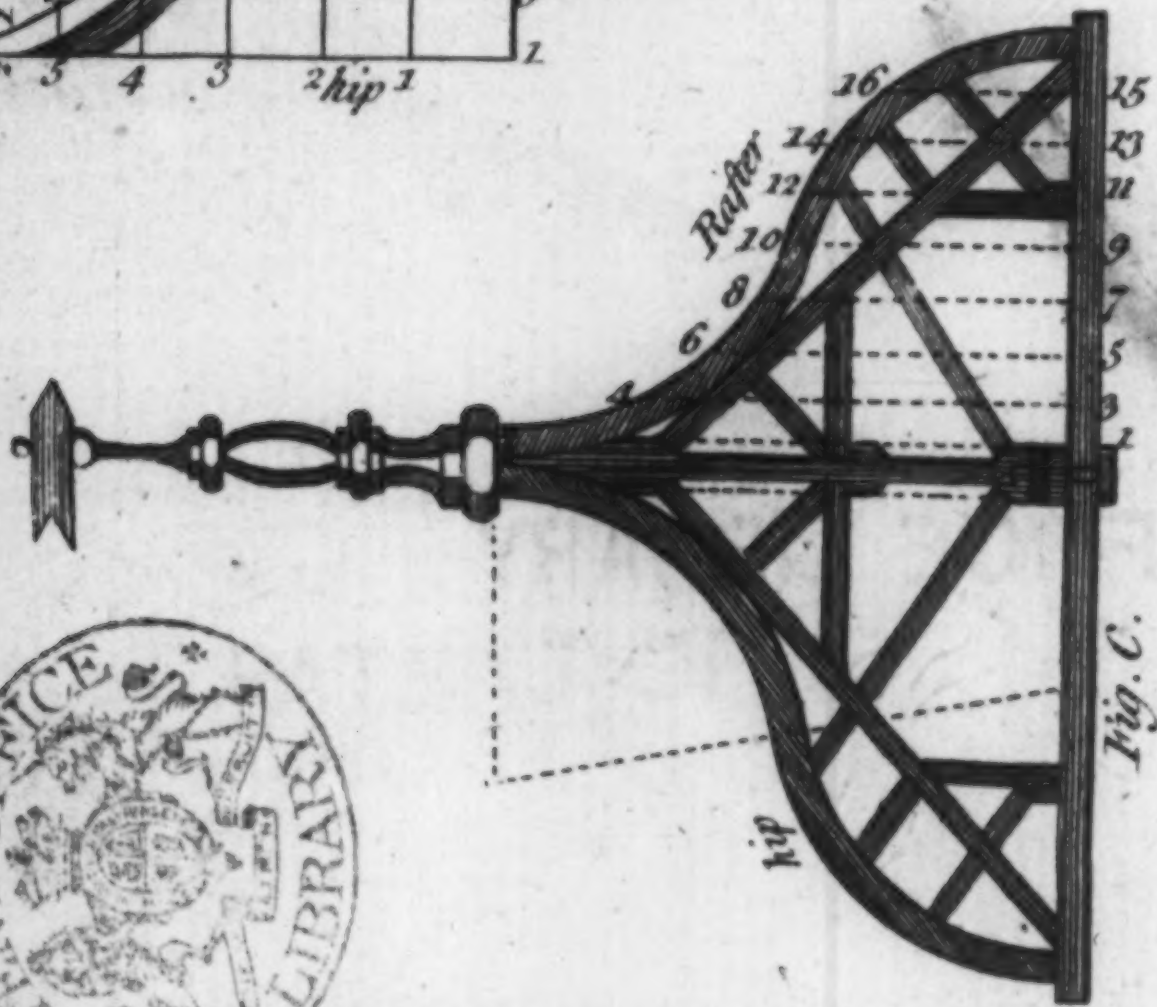
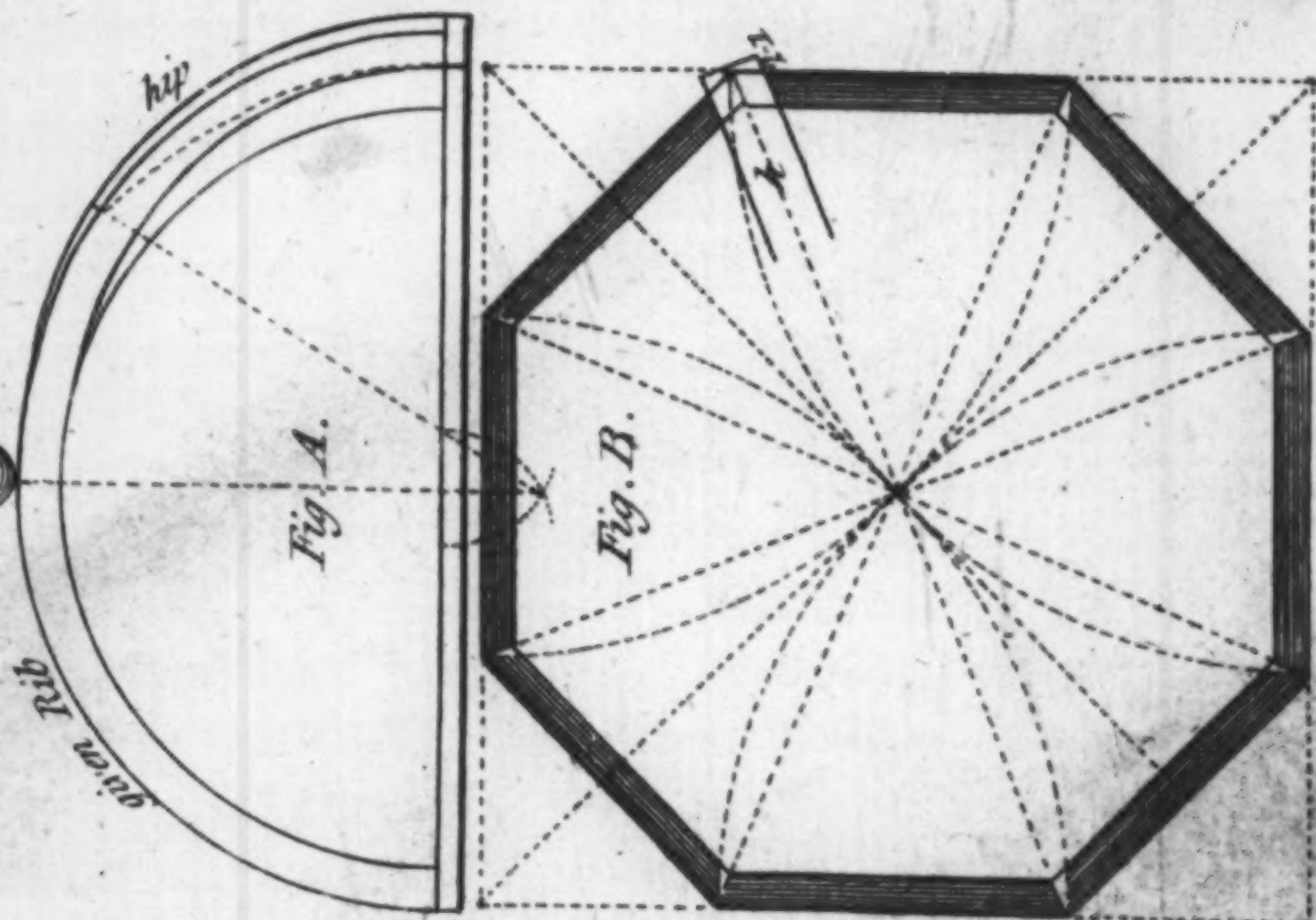
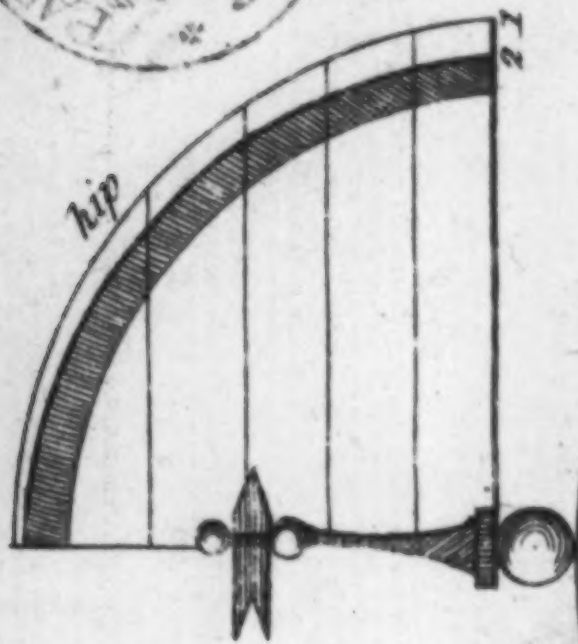
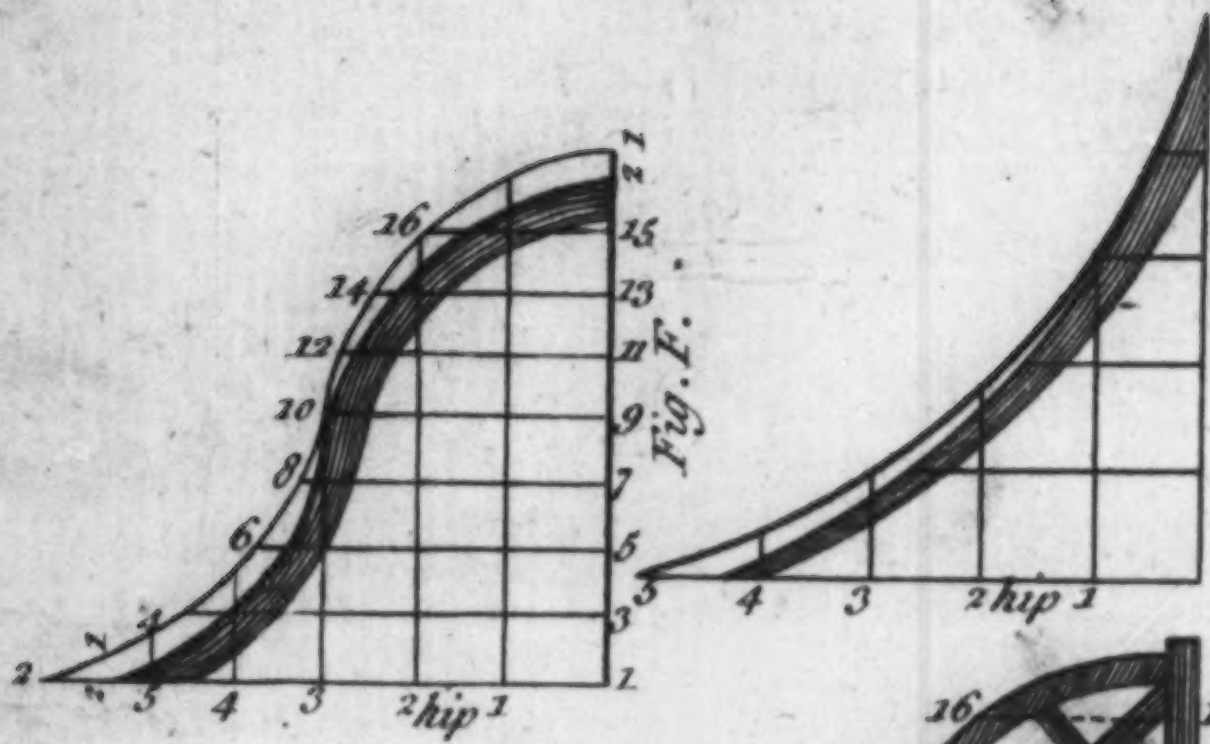


PLATE XIII.

Represents Domes for Temples, Pavilions, &c.

FIG. A is a dome on the octagon plan.

Fig. B, Fig. C are trusses for an ogee-roof on the said octagon plan. One side of the truss is the rafter, and the other the hip.

Fig. E and D are roofs supposed to be set on octagon plans, and the ceiling to be a dome.

To find the length and backing of curve-line hips, divide the base-line of the rafter into a number of equal parts, and draw the dotted lines to the back of the rafter as in *Fig. C*; then divide the base-line of the hips, *Fig. F*, into the same number of parts, and take them off the rafter, and set them on the hip, *Fig. F*, as 1—2, 3—4, 5—6, 7—8, 9—10, &c. which will give the back of the hip. This method will find the curve of any curve-line hip. The hip in *Fig. A* is drawn by the trammel.

To find the backing of the hips, lay down the plan of the hip *b* in *Fig. B*, for the edge to touch the angle; then take off the distance from the plan of the hip, the distance 1—2 and set it on the hip *Fig. F* 1—2, and the same at the top, and shift the mould and mark it; that will give the backing of the hip *Fig. A*: the mould must go off to nothing at the top.

P L A T T E XIV.

FIG. A represents a truss-roof for a church or chapel, a bridged roof.

Fig. B is a trussed roof, with a very large span for a church or chapel. The posts *a* and *b* are supposed to go down to the bottom or pavement, and to be covered with columns and entablatures.

Fig. C is a truss for a large building, temple, or pavilion, with a flat and balustrade on the top.

To find the length and backing of curve-line hips, divide the base-line of the truss into a number of equal parts, and draw the dotted lines to the back of the truss as in Fig. C; then divide the base-line of the hips, Fig. A, into the same number of parts, and take them off the latter, and set them on the hip, Fig. A, as 1—2, 3—4, 5—6, 7—8, 9—10, &c. which will give the back of the hip. This method will find the curve of any curve-line hip. The hip in Fig. A is drawn by the trammel.

To find the backing of the hips, lay down the plan of the hip in Fig. B, for the edge to touch the angle; then take off the distance from the plan of the hip, the distance 1—2 and set it on the hip Fig. A 1—2, and the same at the top, and shift the mould and mark it; that will give the backing of the hip Fig. A; the mould must go off to nothing at the top.

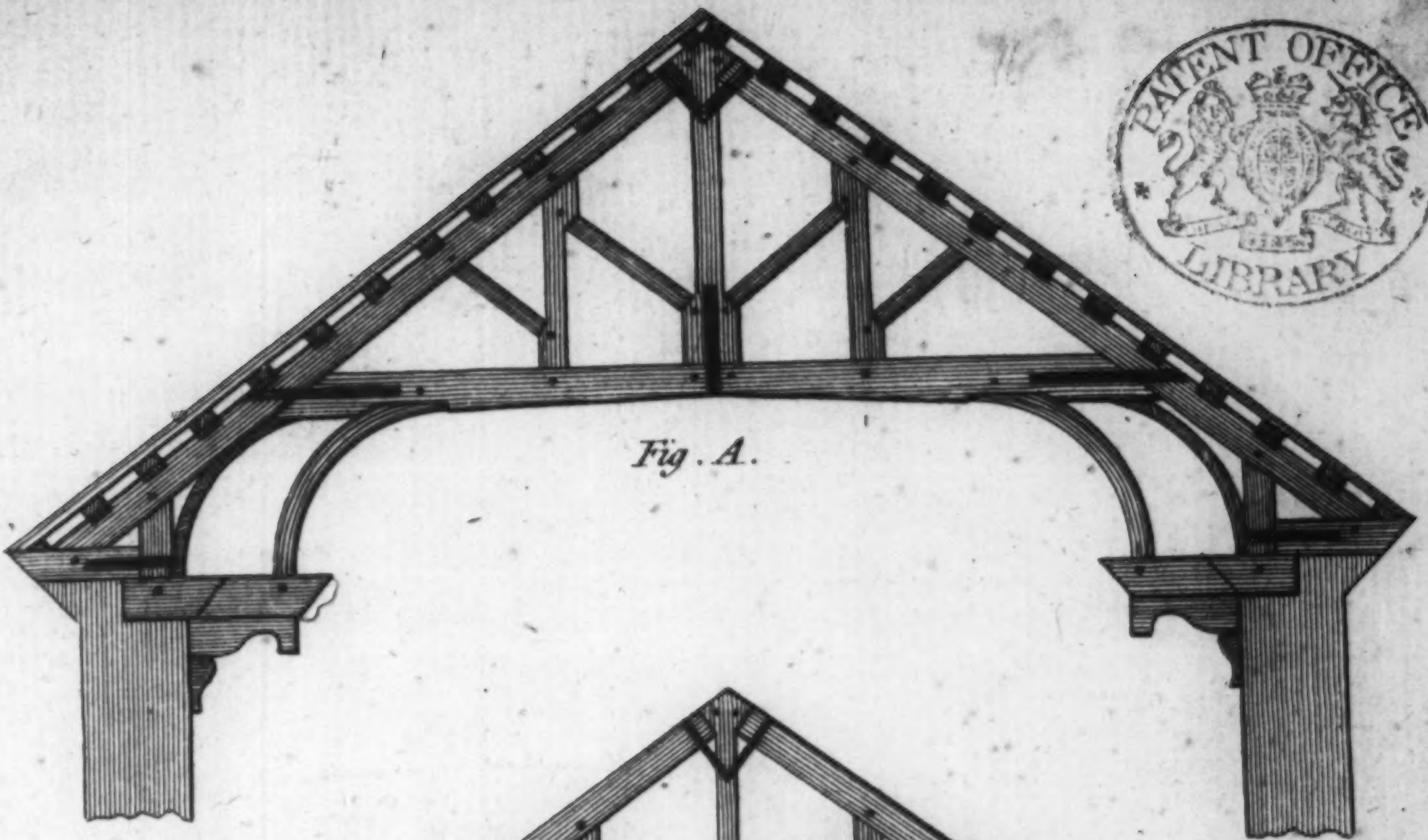


Fig. A.

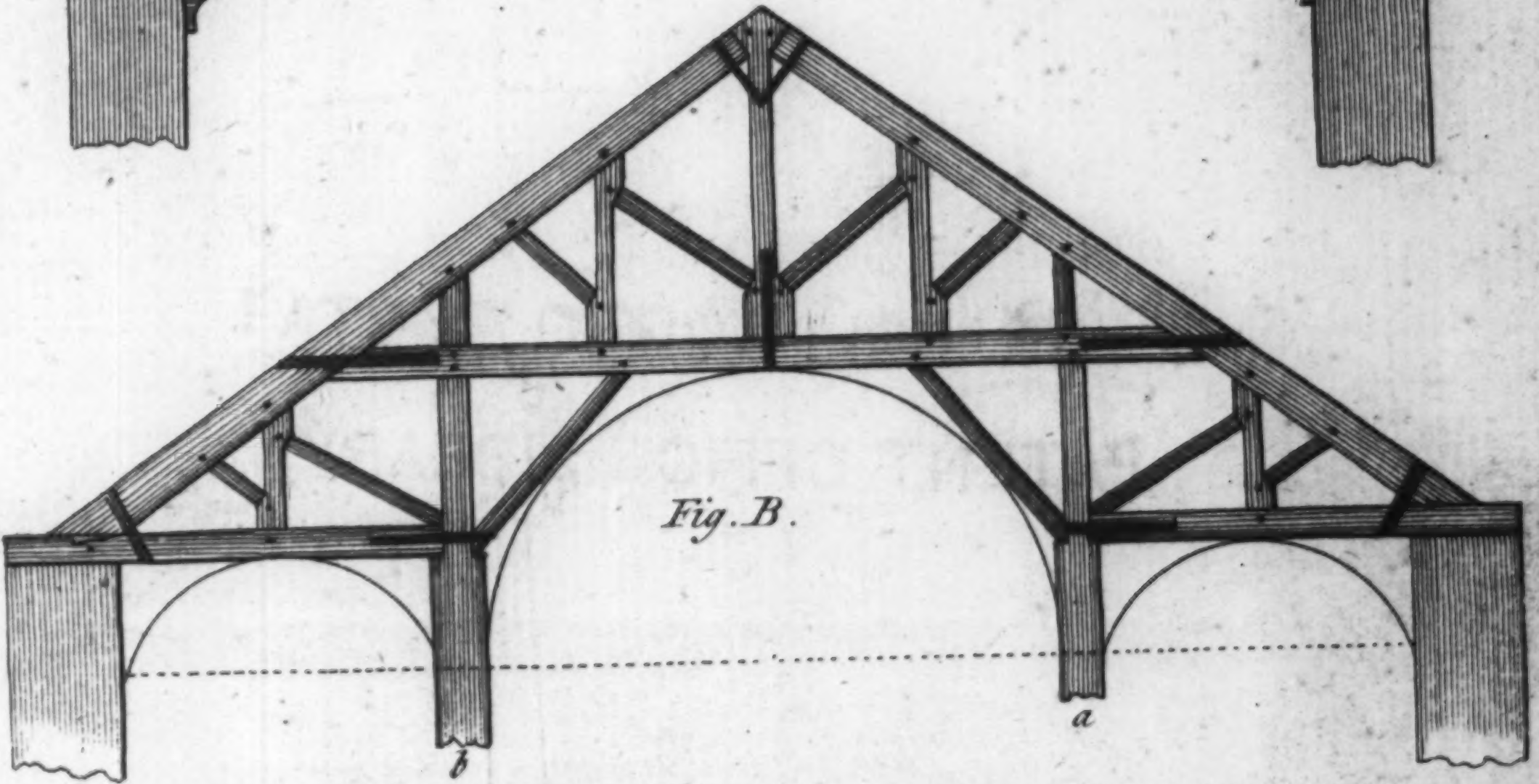


Fig. B.

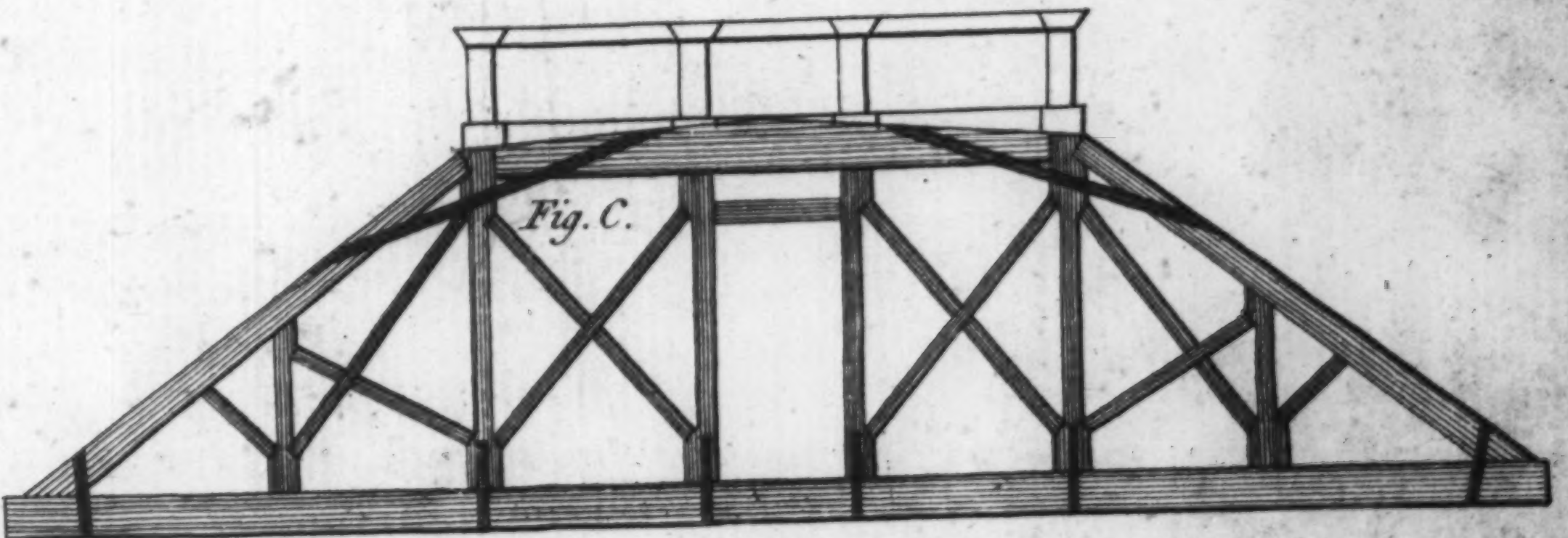
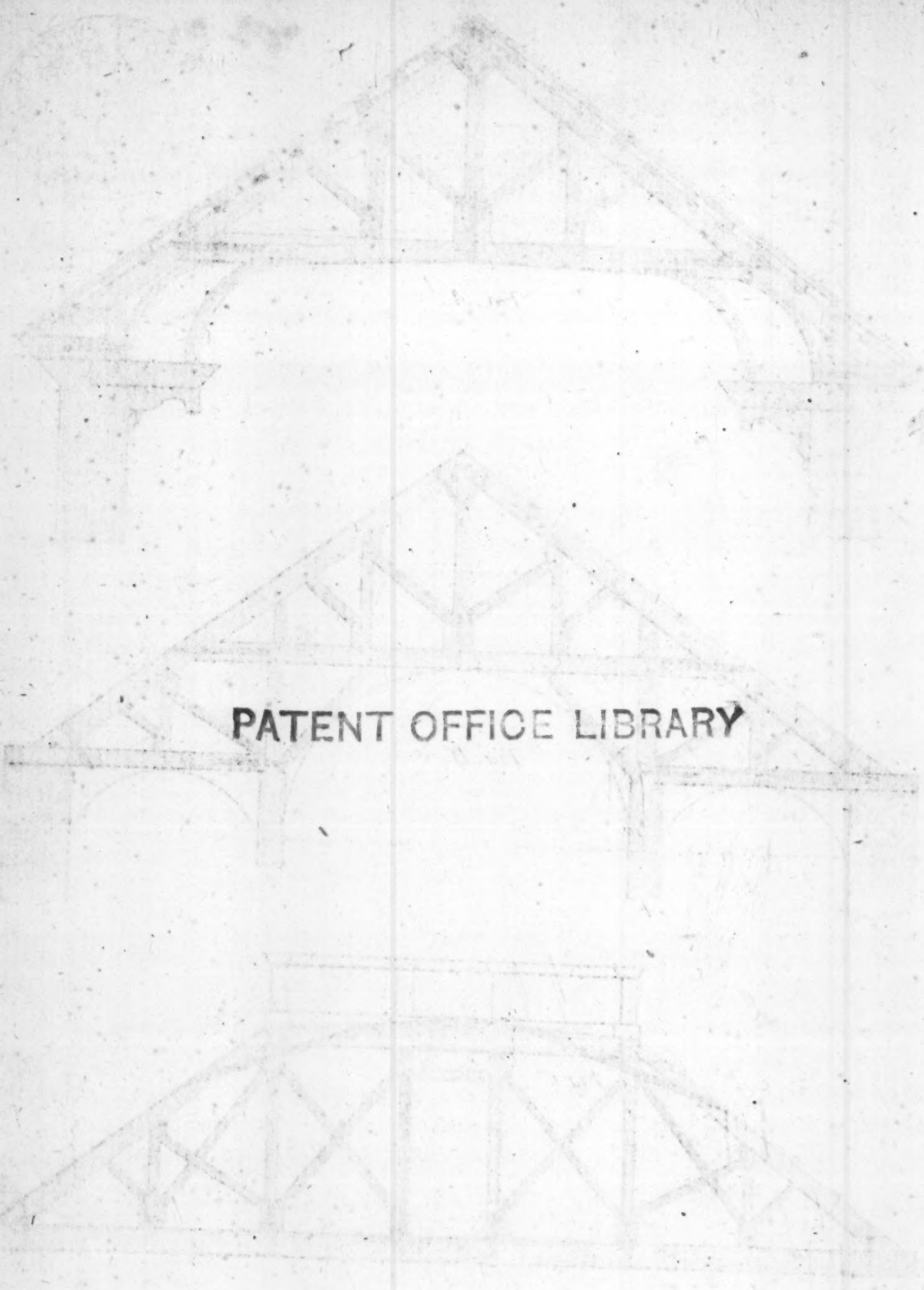


Fig. C.

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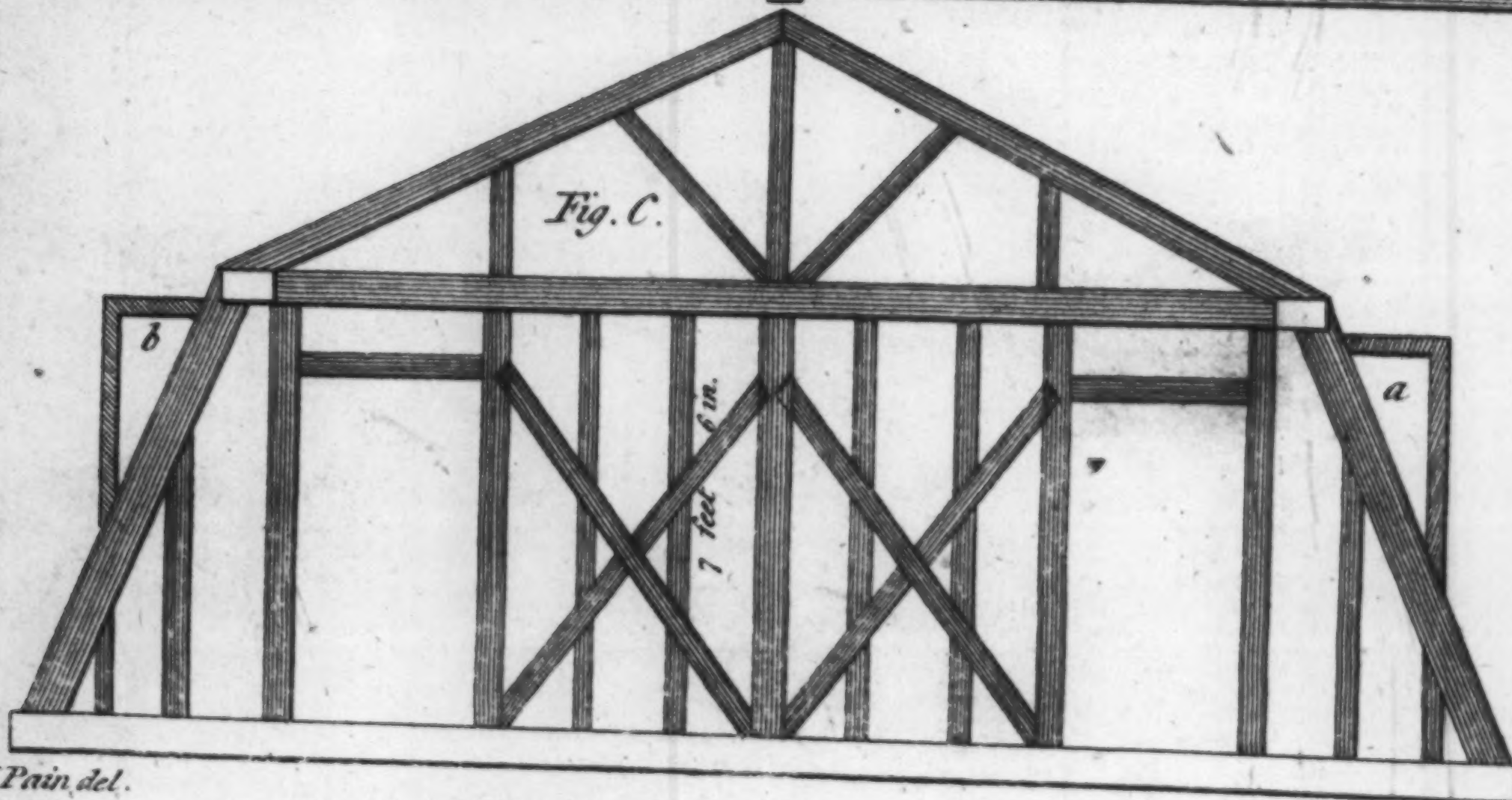
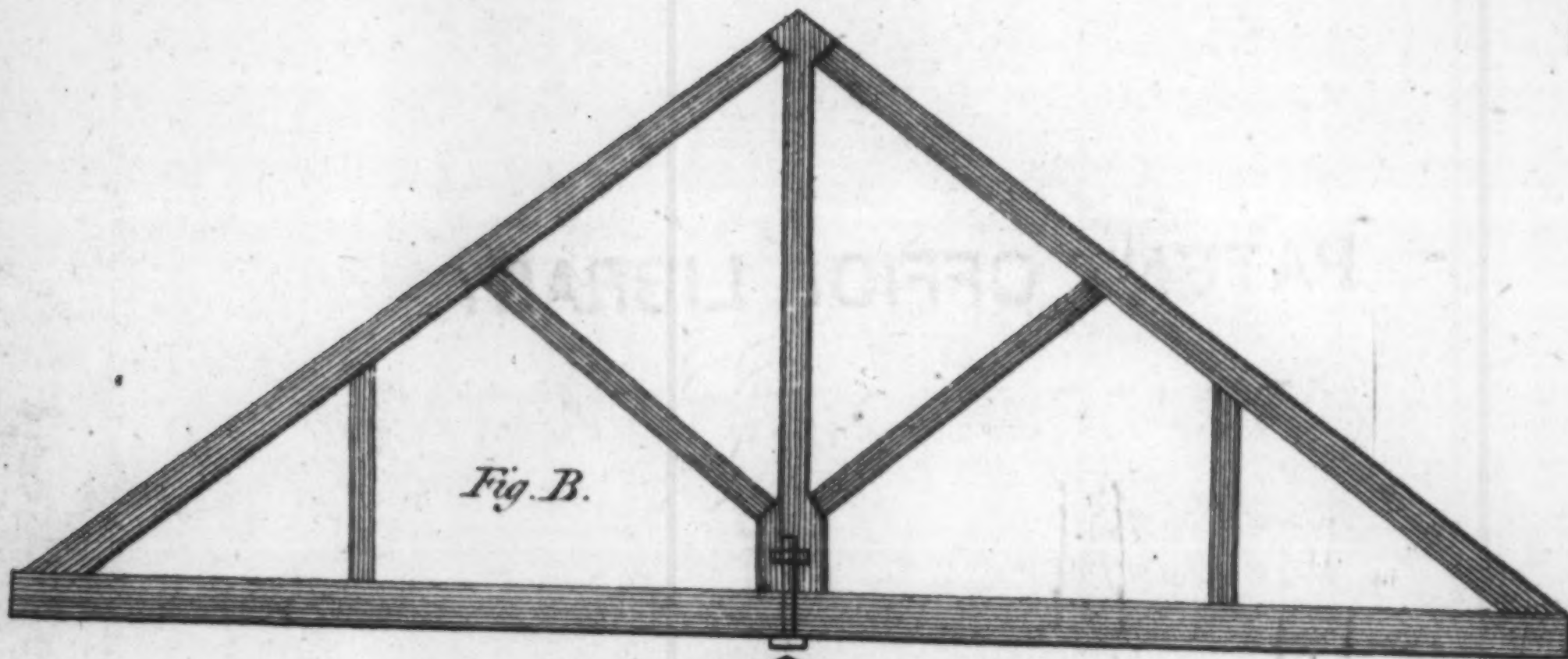
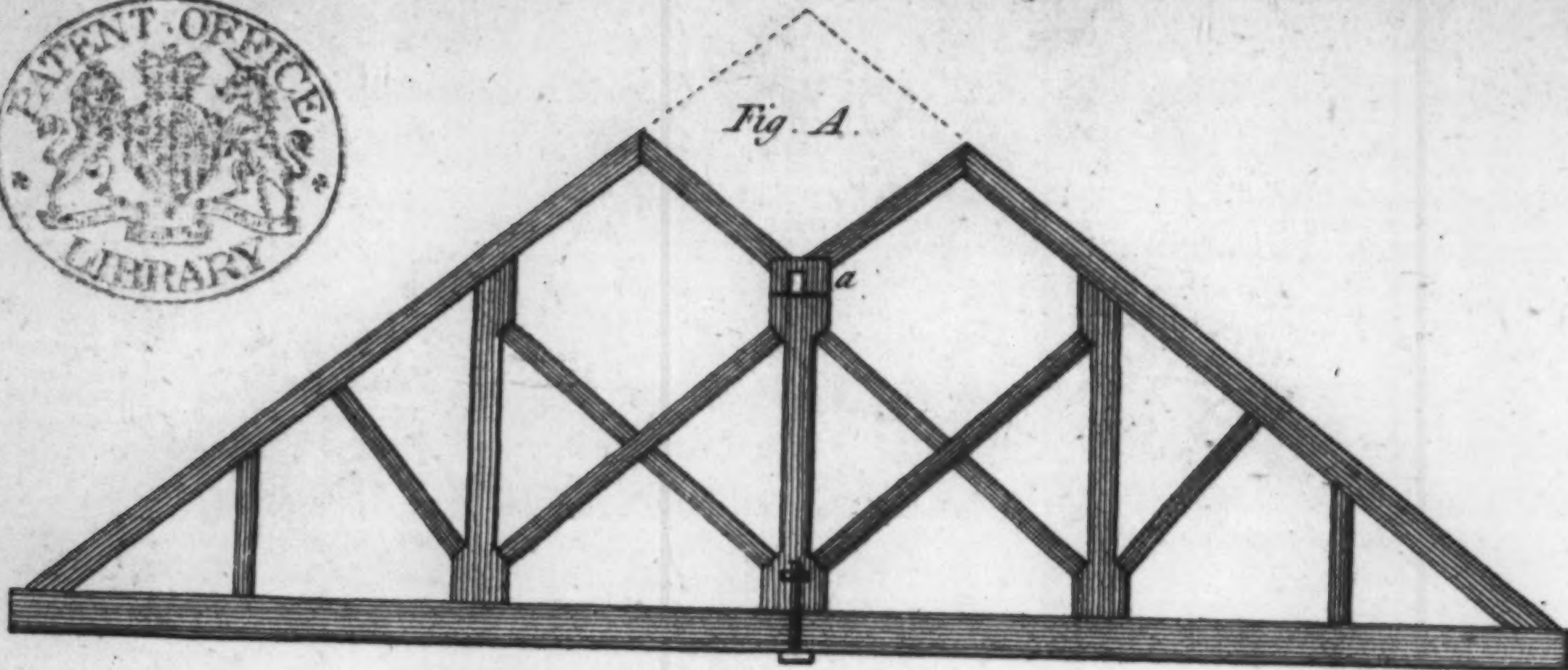


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PVL PLATE XV.

FIG. A represents a double truss for a roof whose rafters are shortened, and pitches on the gutter *A*, framed on the top of the king-post, the whole is plain to inspection.

Fig. B is a single truss for a roof.

Fig. C represents a curb-roof, *a* and *b* dormer-windows. This sort of curb-roof is much the best when garrets are to be in the roof.

P L A T E X V I

FIG. A represents a Centre for a brick or stone arch.

Fig. B a truss for a temple with a bell-roof.

Fig. C a bell-roof with a flat and balustrade at the top.

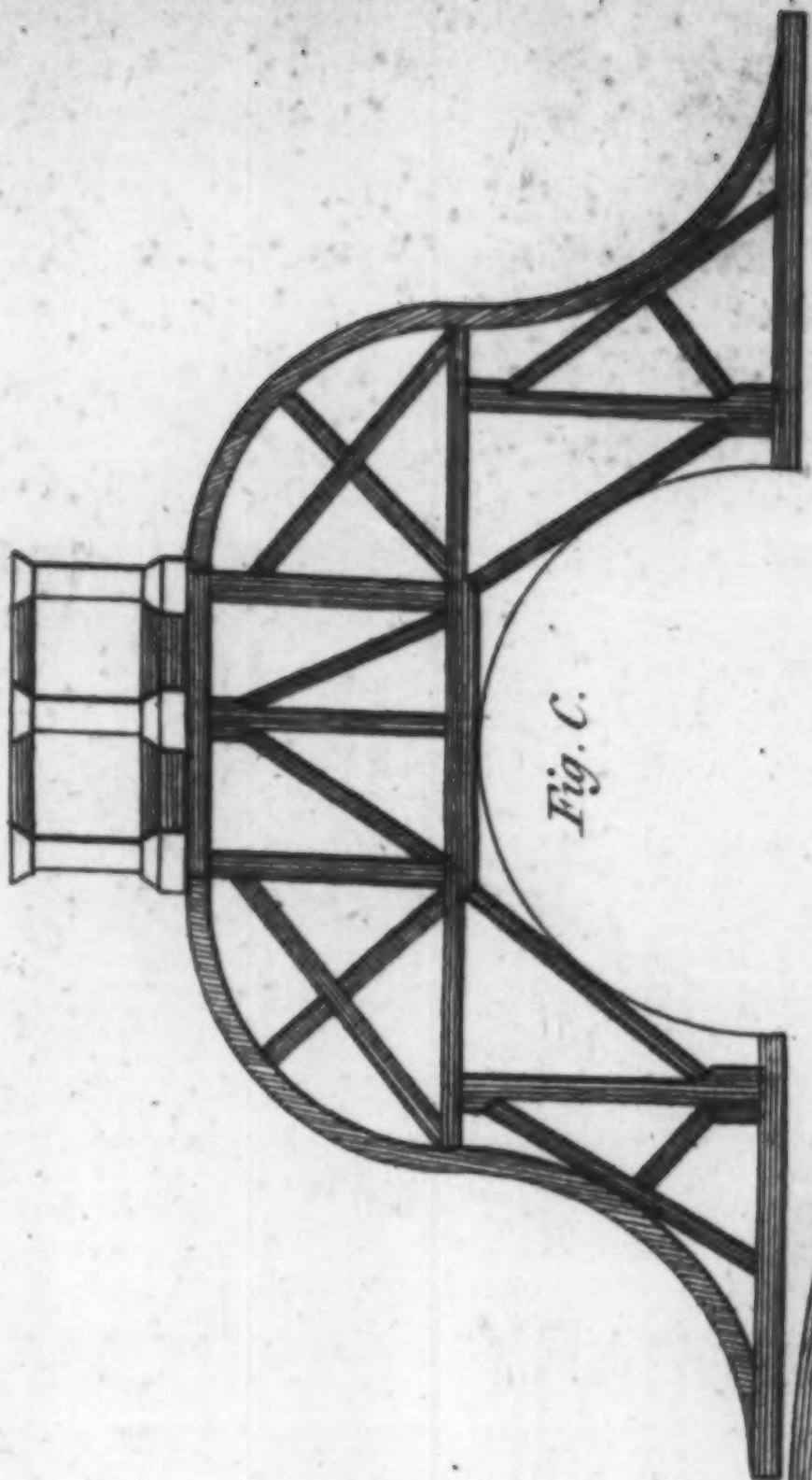


Fig. C.

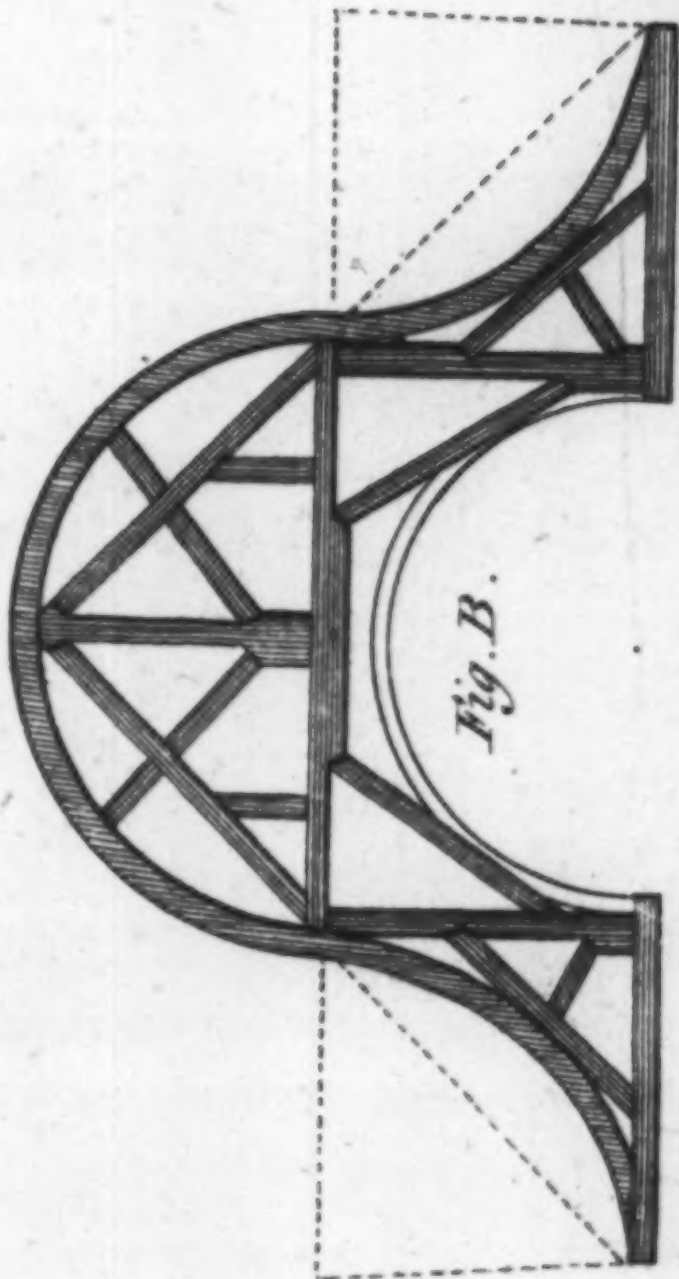


Fig. B.

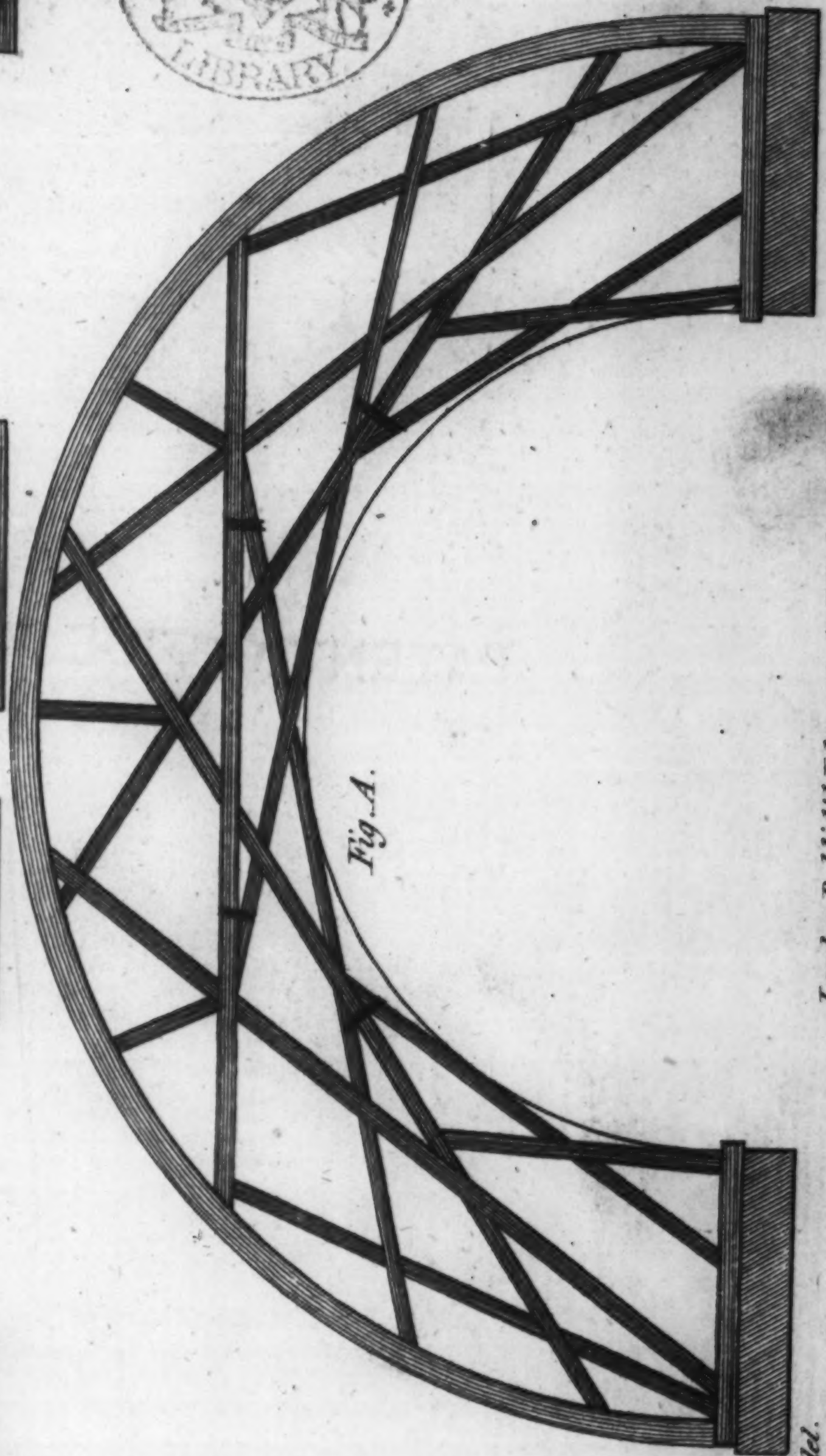


Fig. A.

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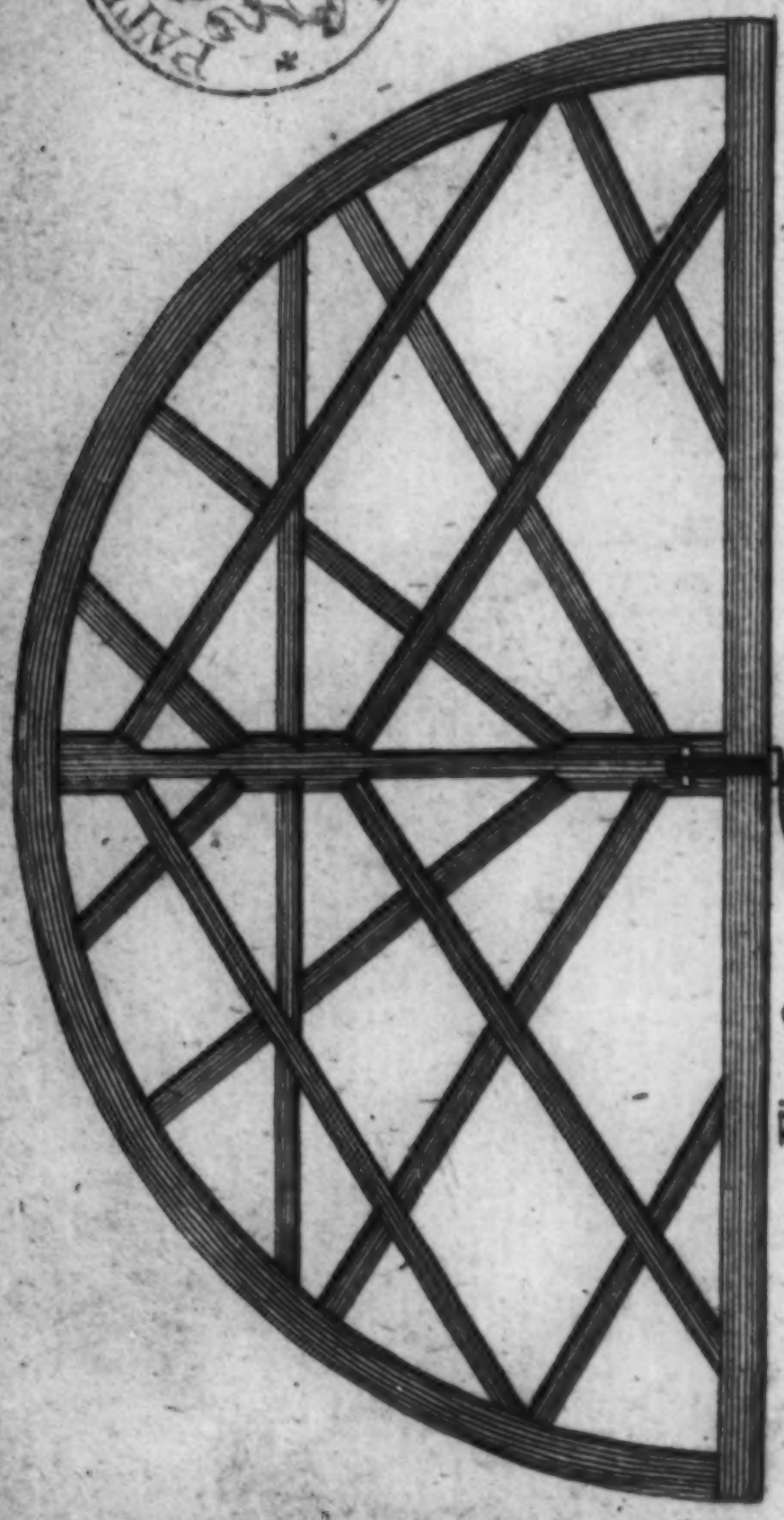


Fig. C.

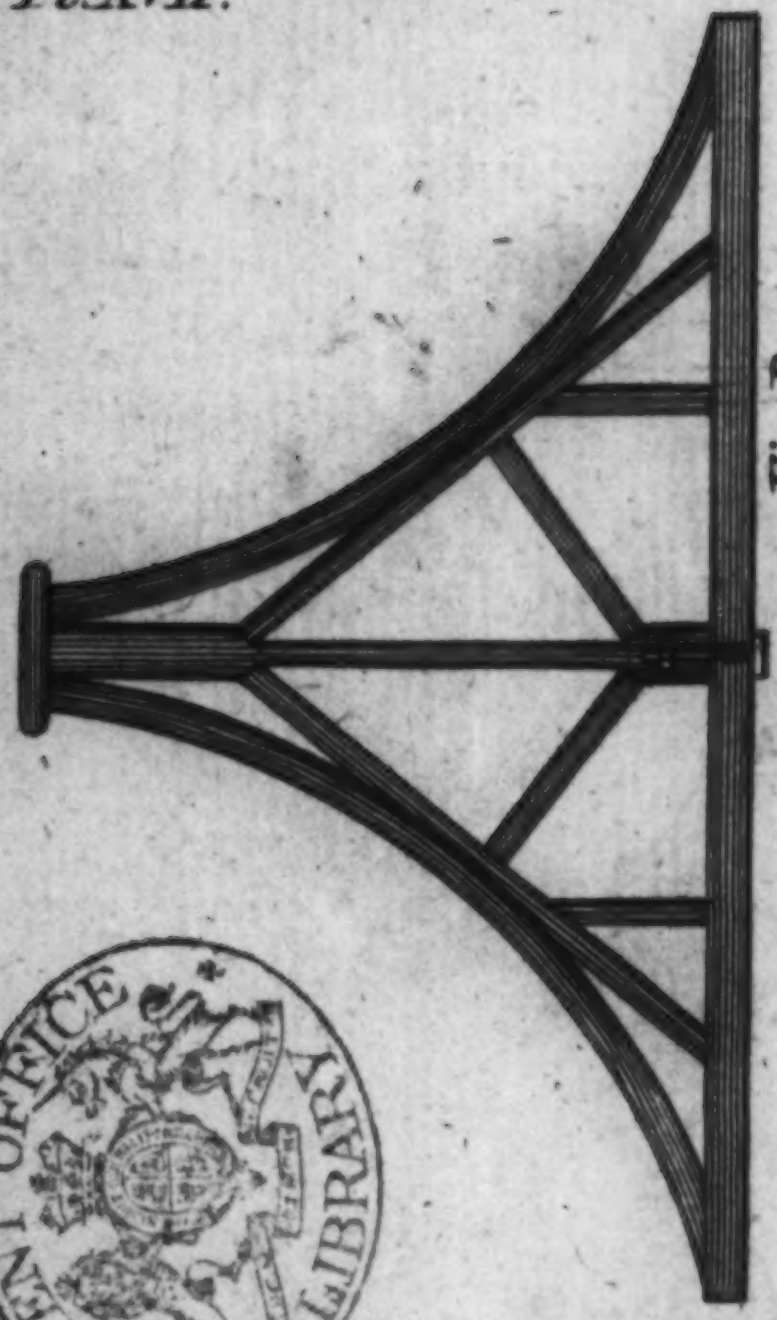


Fig. D.

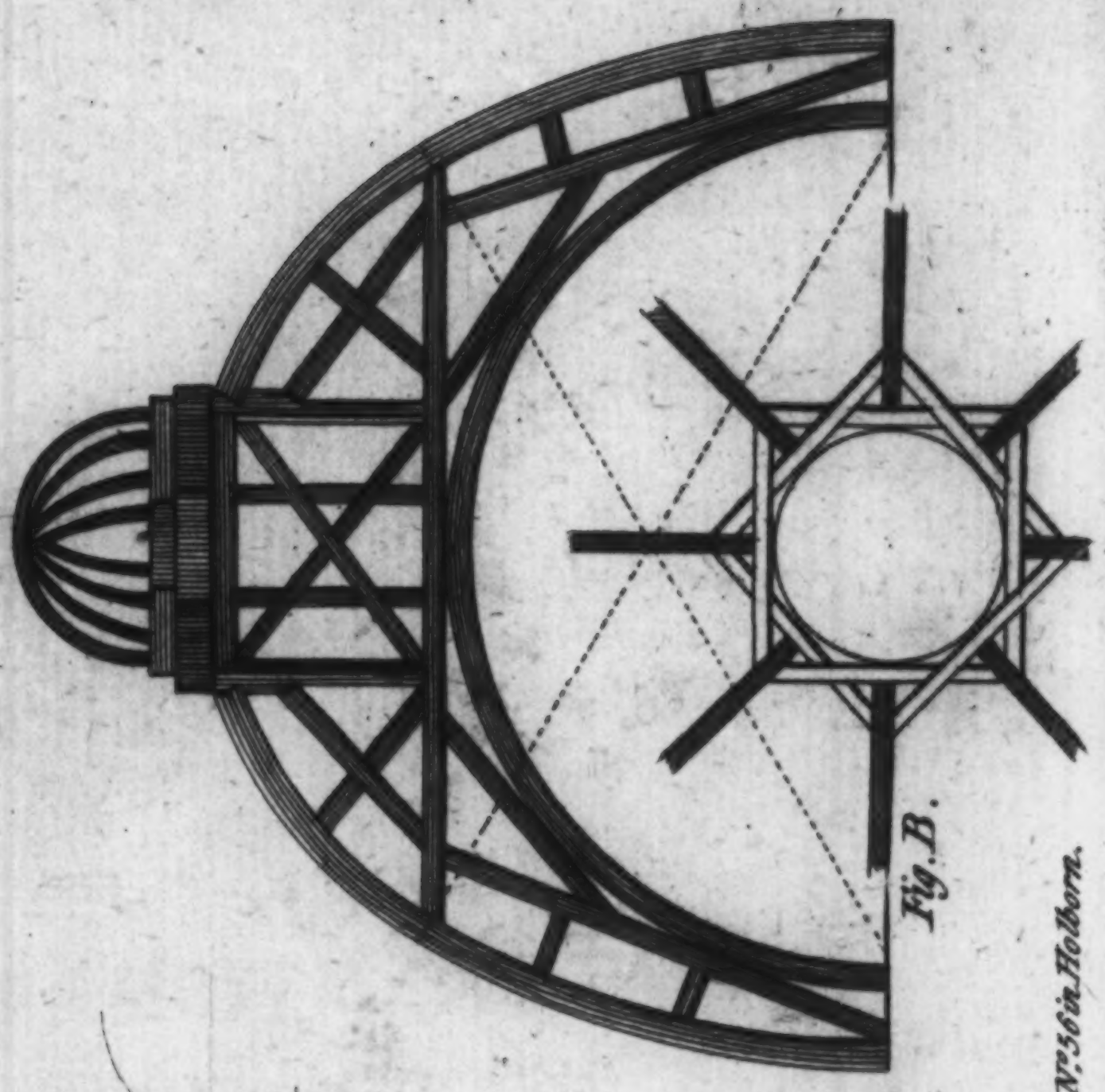


Fig. B.

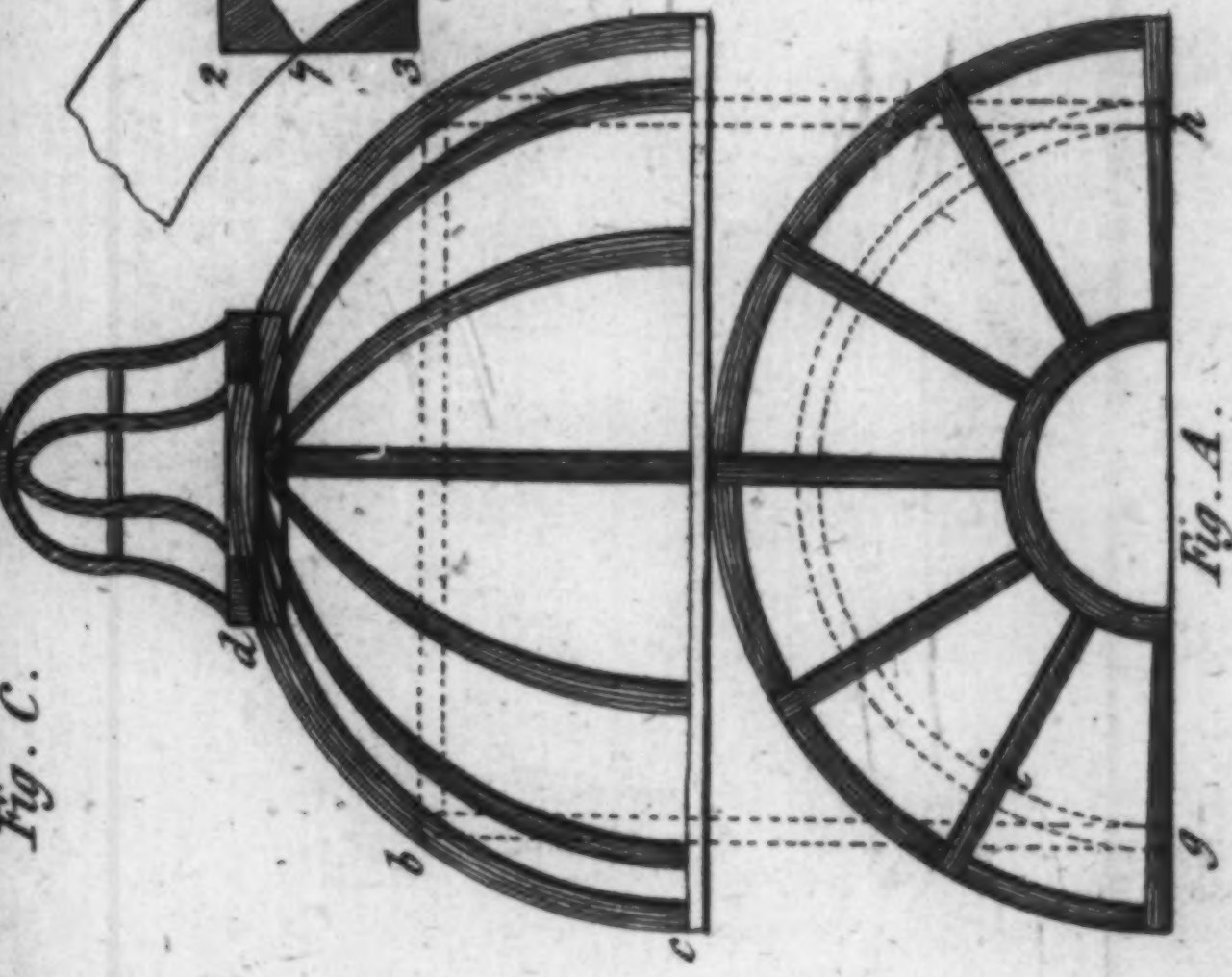


Fig. A.

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P L A T E X V I I .

FIG. A represents a rib-dome with a bell-top, *a* is the method of squaring the purlines. Get the piece as big as the shaded parts 1, 2, 3, 4; then find the place of the purline as at *b*, which divides the dome in two parts as at *d b c*; then drop lines from *b* to the plan at *g*; then draw the arch line *g—b*, that is the plan of the curve of the purline; *g, i* is a mould to work it by; and when squared, make a mould exact to the sweep of the dome as *Fig. E*, to find the true curve. Take off the angles 2, 4; then with the mould *E* draw the curve on the outside as at 5, 6, and the inside 7, 8; when worked off at the angles 1, 3, the purline will be in its right form for framing the ribs into.

Fig. B represents an elliptical dome with a sky-light at the top.

Fig. C a centre for a stone or brick arch.

Fig. D a caveto for a temple. *HTS*

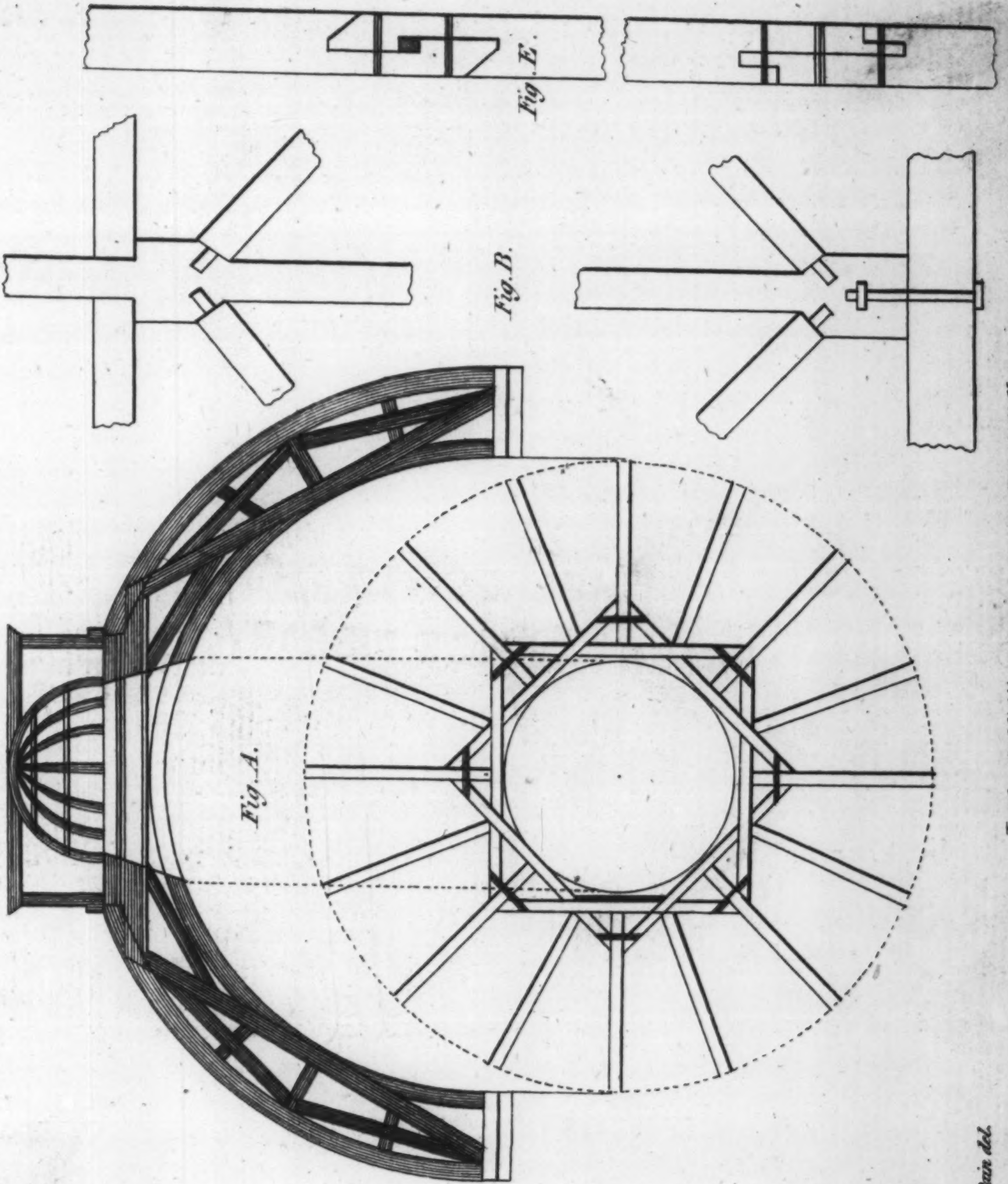
HTS

PLATE XVIII.

FIG. A represents a large dome on a circular plan, with a skylight and balustrade at top for a temple, &c.

Fig. B shews the manner of trussing partitions, bearings, &c.

Fig. E scarfing of plates.



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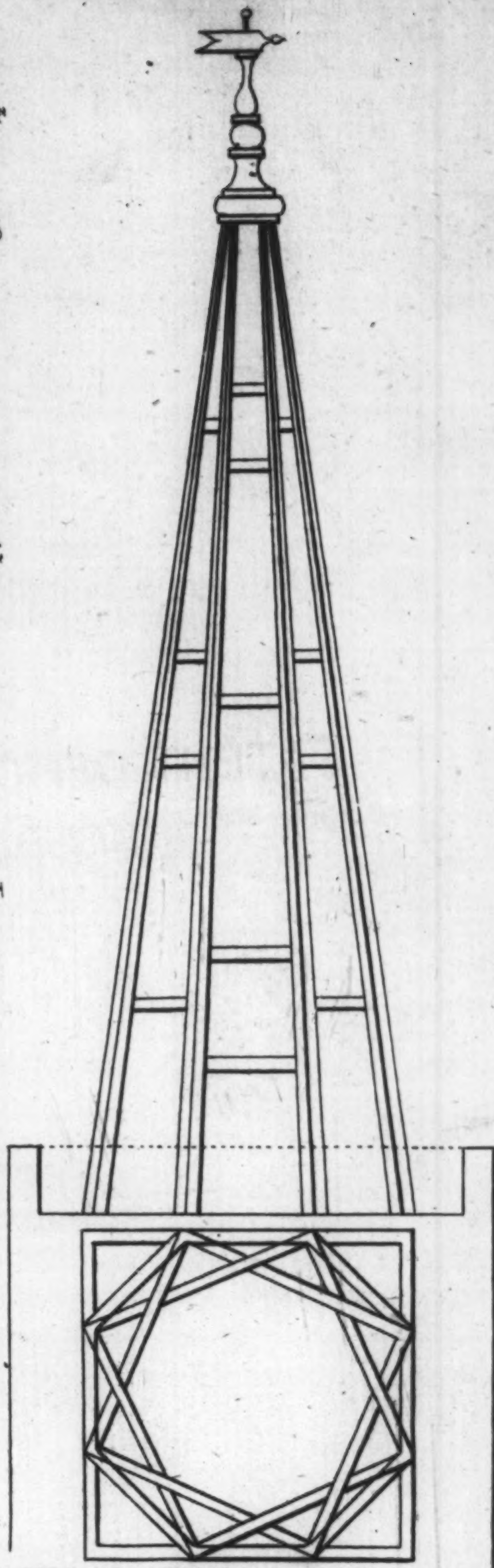
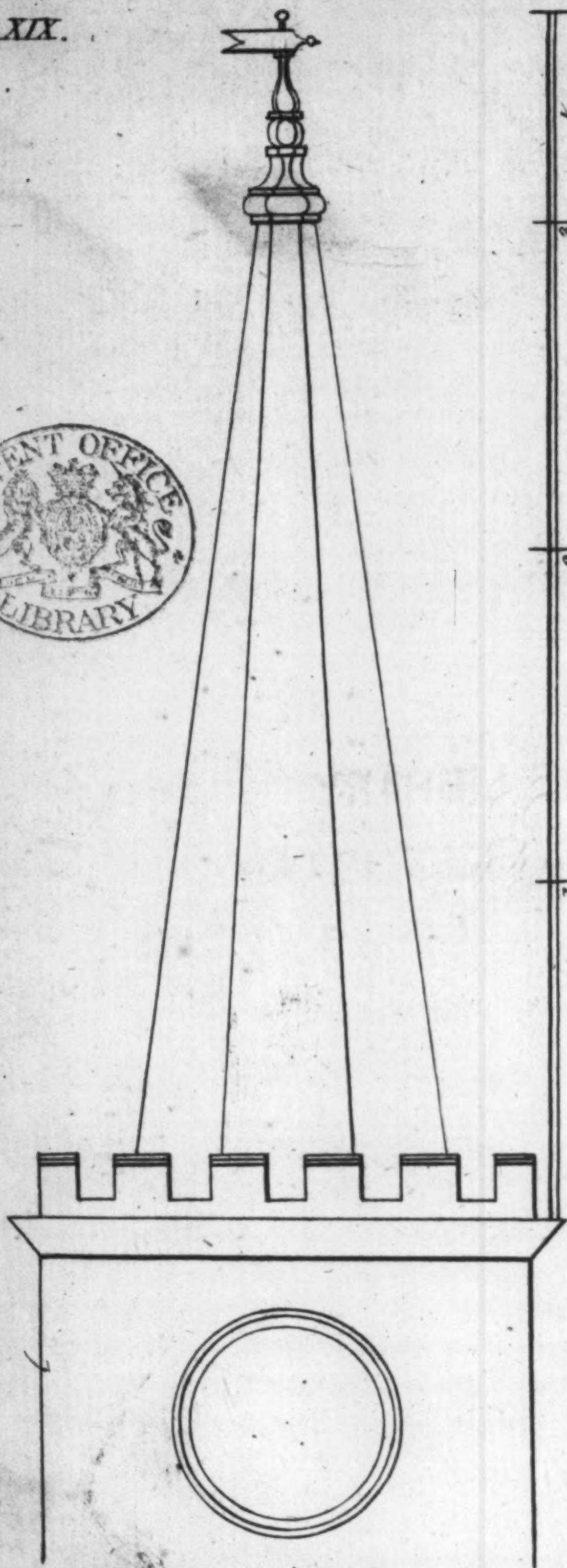


PLATE XIX.

Shews the Manner of framing Spires for Country Churches, &c.

THE height of the spire is three times the diameter and one half to the top of the vane; the body of the spire three times the diameter of the curb it stands on, which is 12 feet: so the body of the spire is 36 feet high, the neck and vane 6 feet high, the whole height 42 feet; the walls 3 feet 9 inches thick for the towers which the spire stands on.

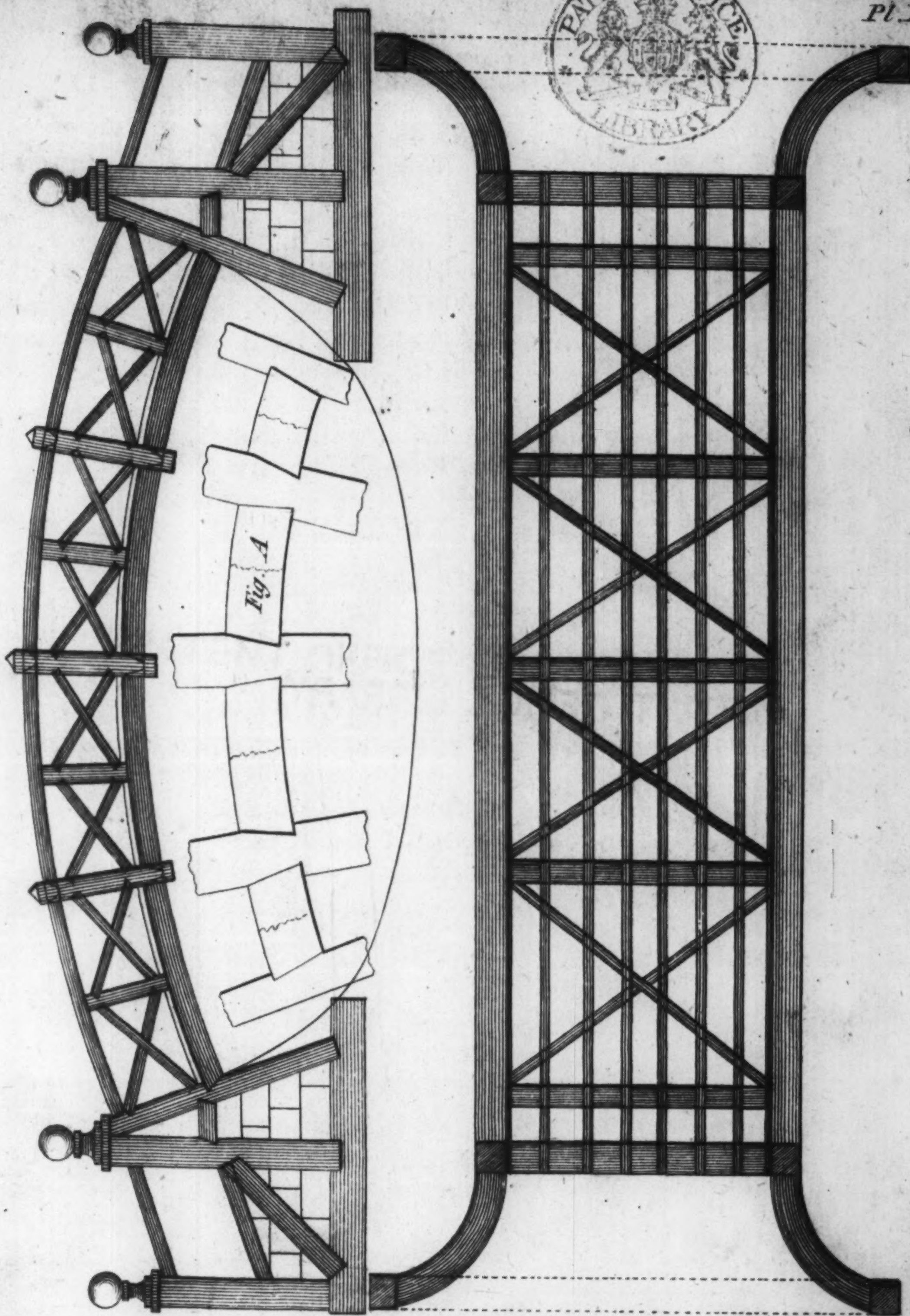
PLATE XX

Represents a trussed Bridge whose Span is sixty Feet.

FIG. A shews the manner of butments, &c. as is plain to inspection.



Pl. XX.

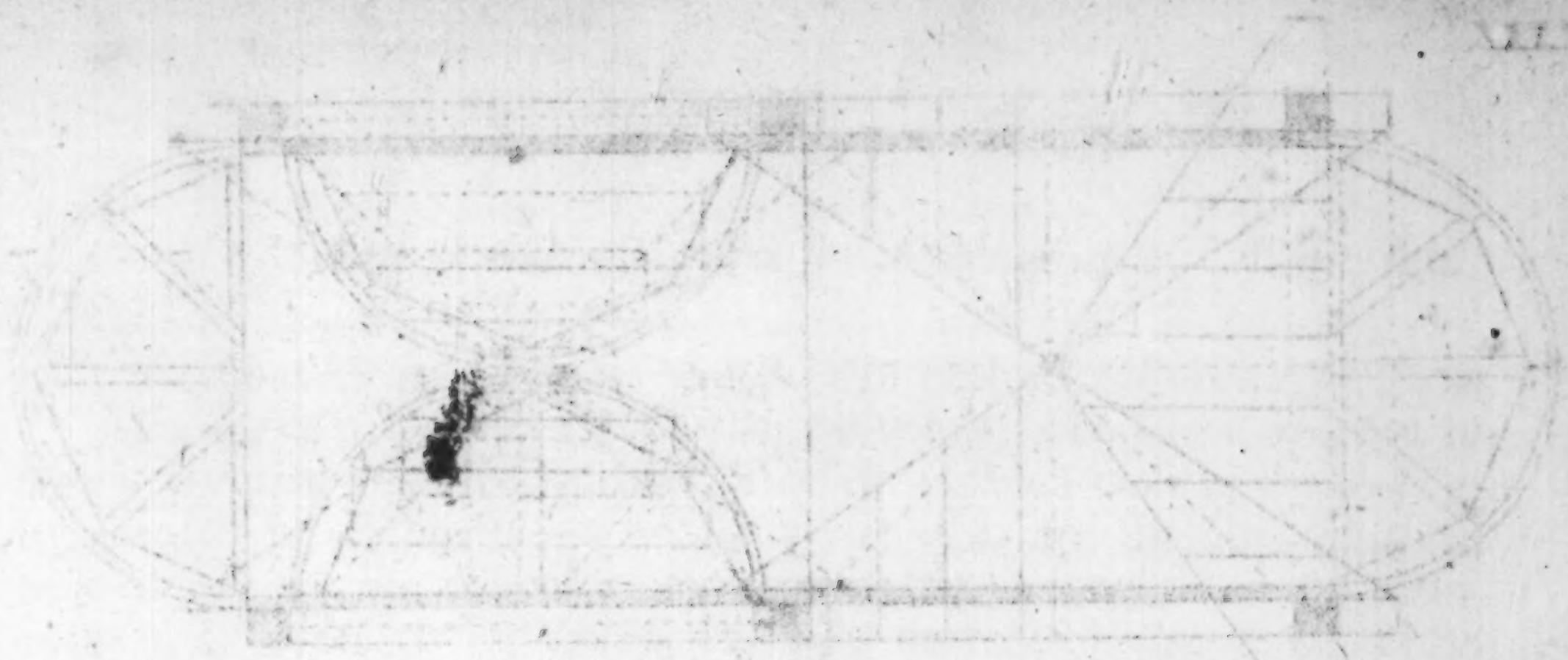


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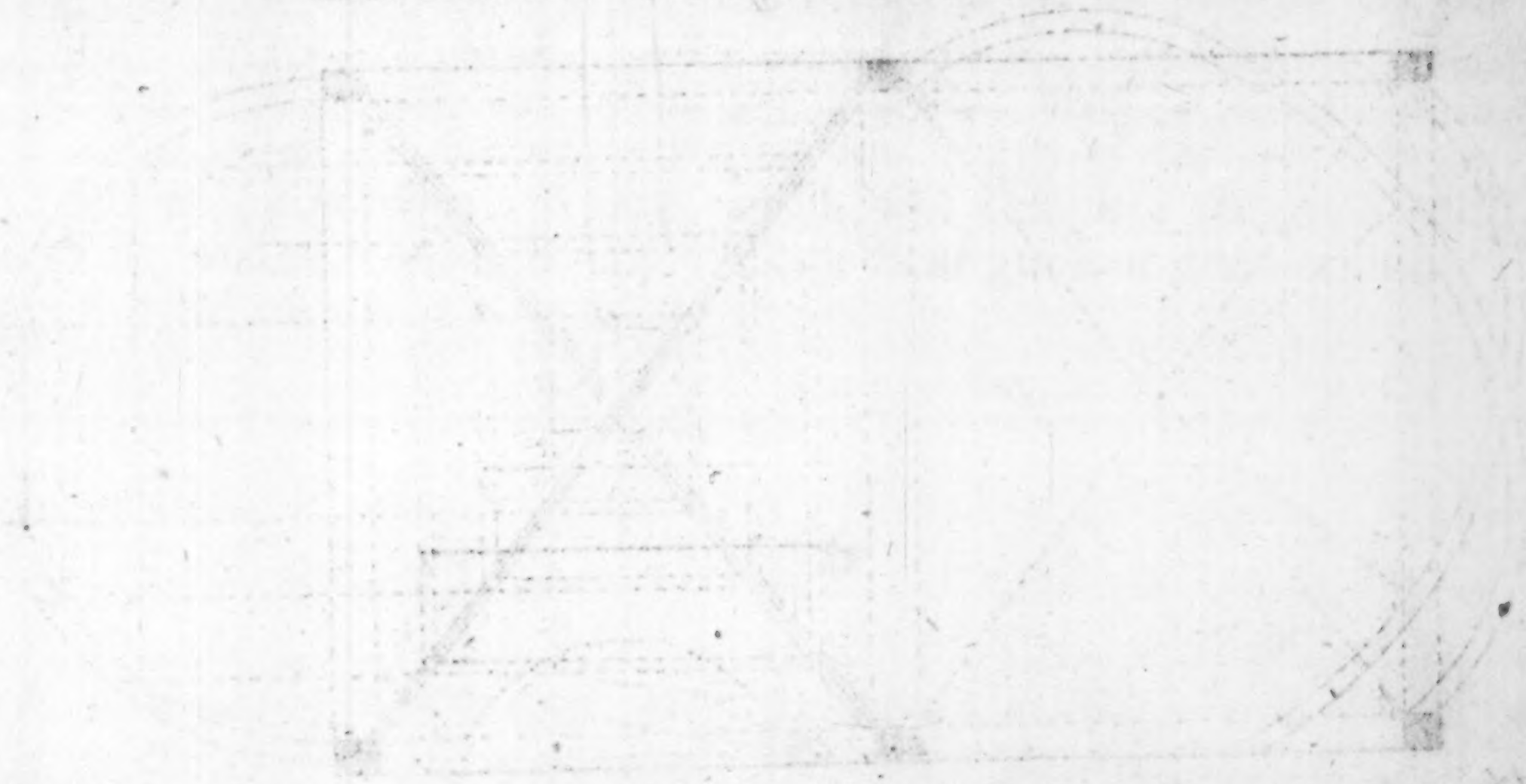
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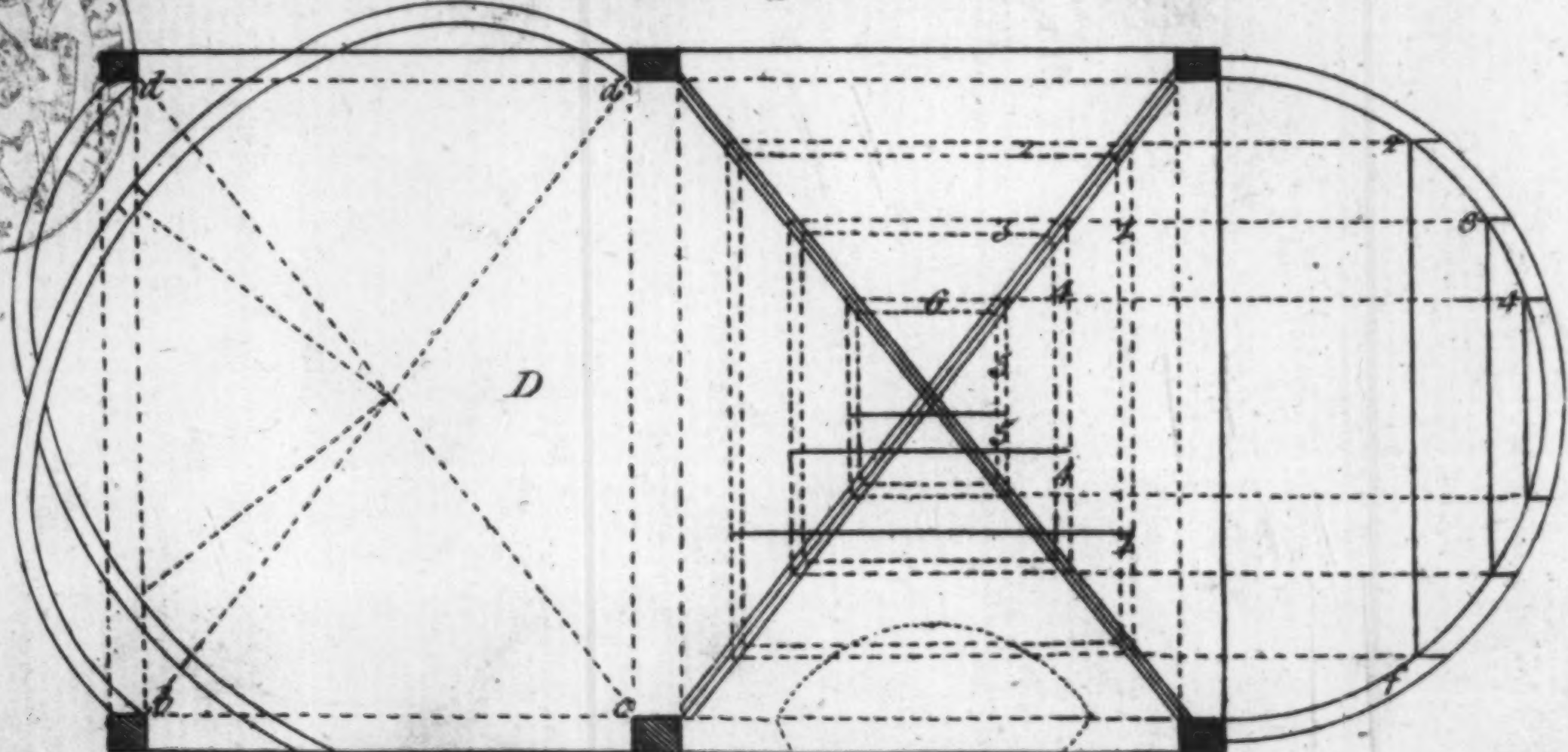
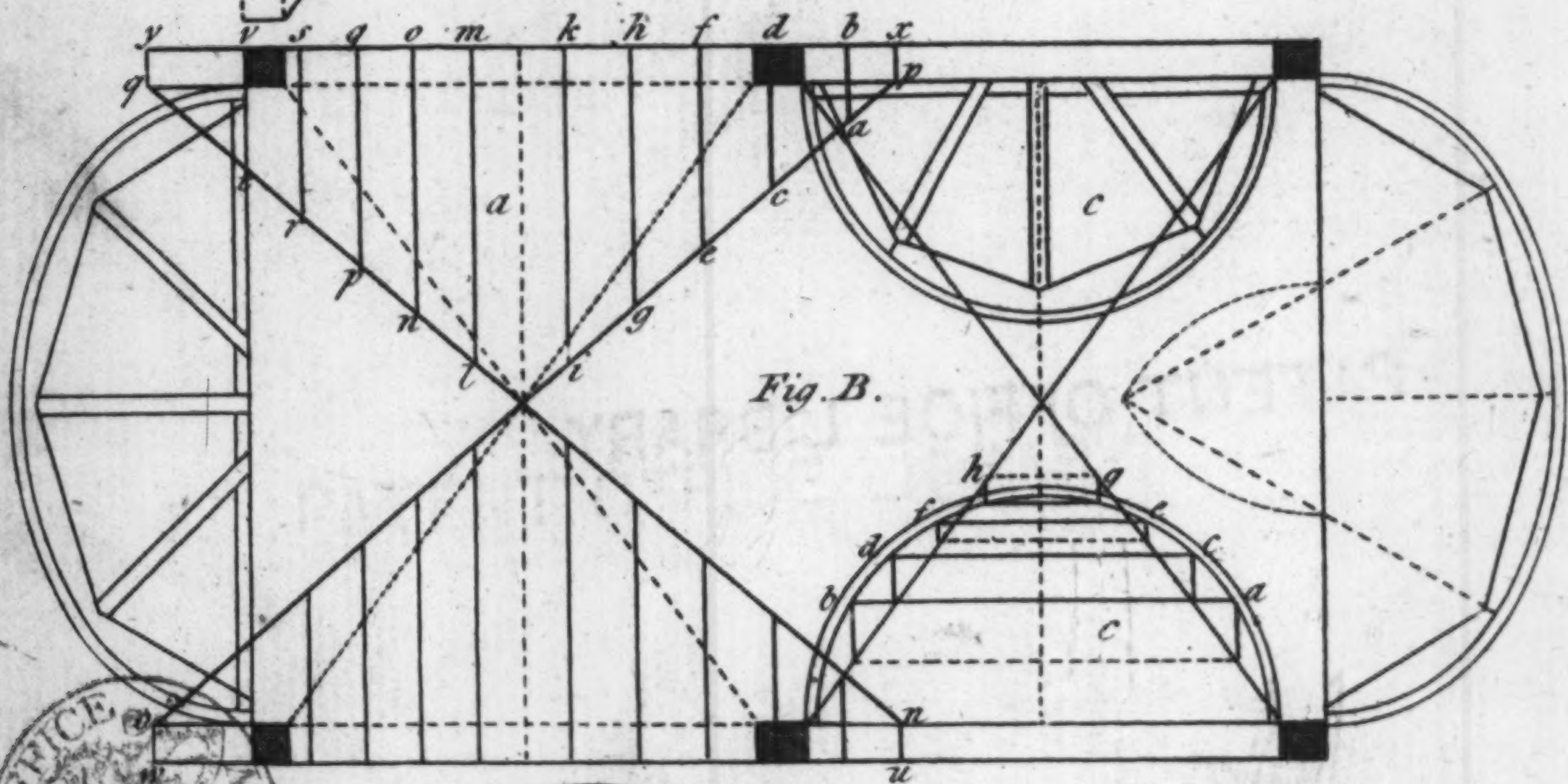
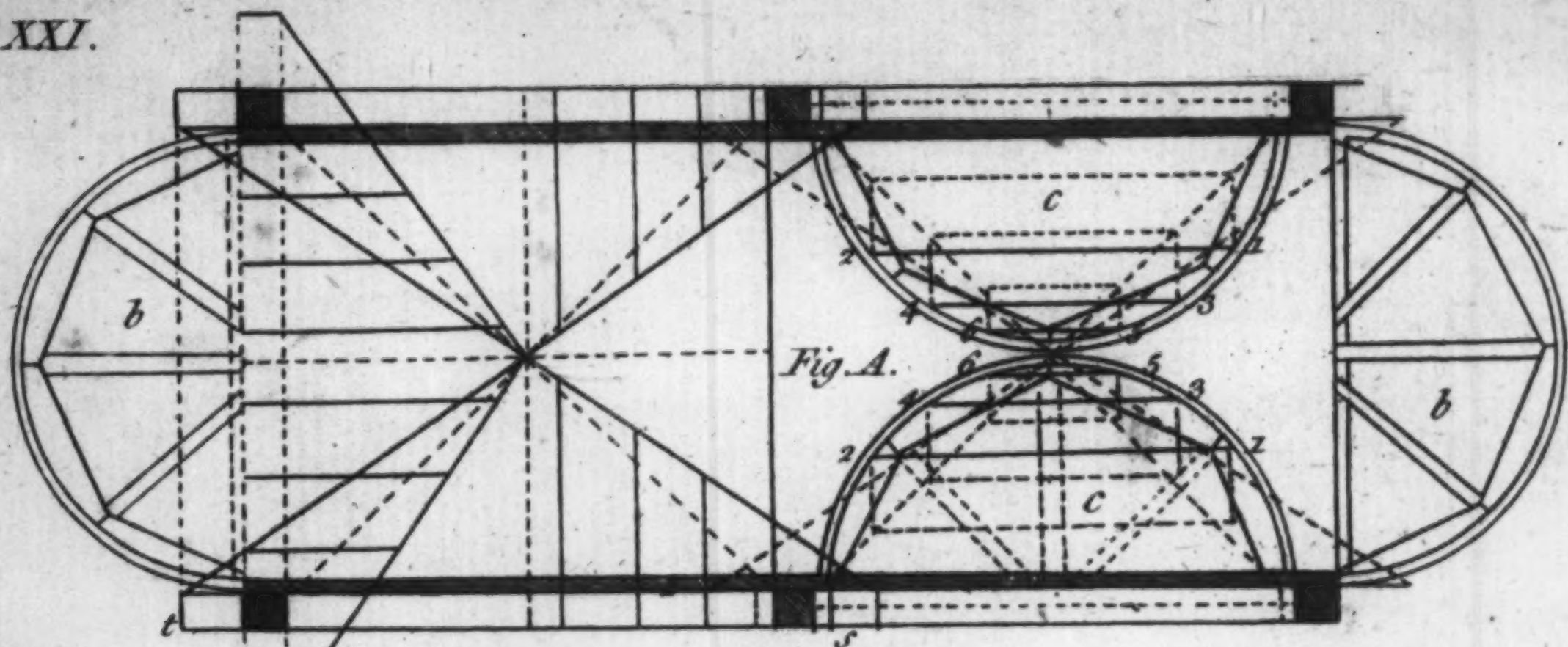


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P L A T E X X I .

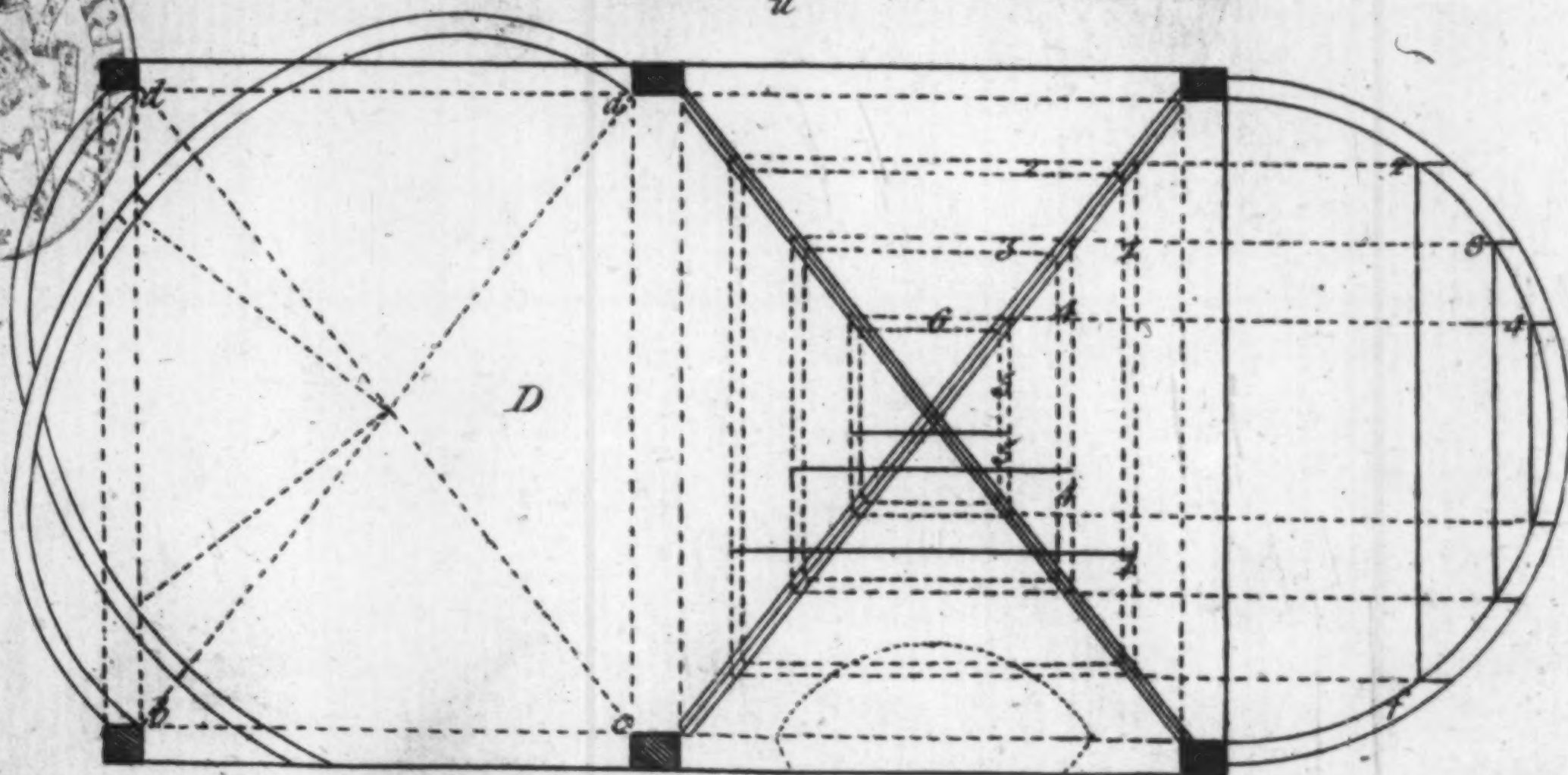
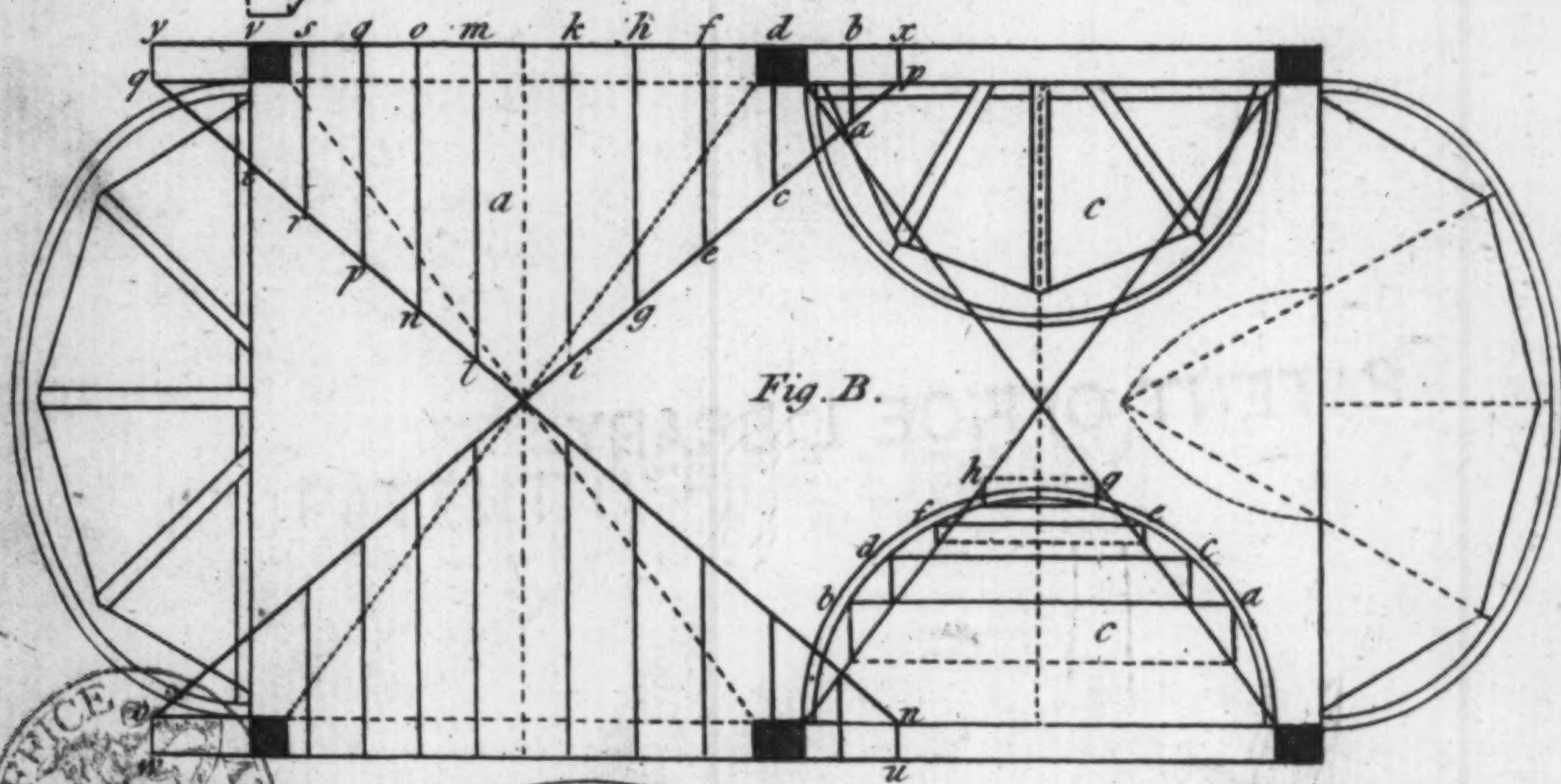
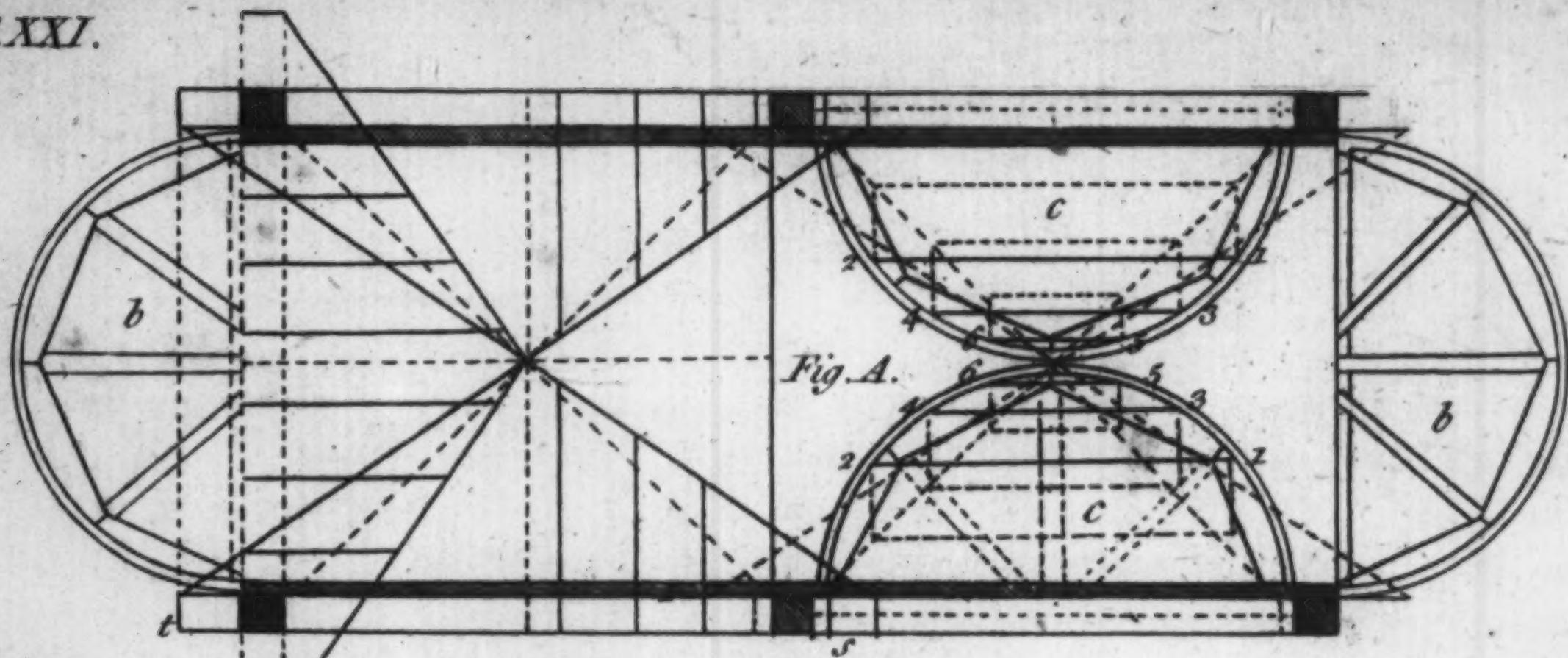
Shows the Method of making Centres for Arches, Vaults, Ceilings, &c.

FIG. *A* and *B* are plans to be arched or groined with brick or stone, *b, b*, the centres for the body-range which is to be set on quarters or temporary plates for that purpose, which is to stand close to the piers as represented by the line 1—2 on the plan: *c, c*, are the ribs to cut the jack-rafters or ribs out of as marked on the centre, when the body-range *b, b*, is set and boarded, then the centres *c, c*, are to be cut as marked by the lines 1—2, 3—4, 5—6, and the whole ribs *b b*, to stand on the recess between the piers; then board them.

Now, to find the mitre-cut for the boarding, take the girt of the centre *c* and stretch it out as *s t* or *u w* and *x y*; then draw the lines *a—b*, *c—d*, *e—f*, *g—h*, *i—k*, *l—m*, and so on to *t—u*, and the space between these lines will represent the cover or boarding of the groin, whose mitre-cut is represented by the black lines drawn from *o* to *p*, and from *n* to *q*, when the boarding is cut as the lines direct; fixed on the centres they will make the angles of the groin complete.

Fig. B the body-range is an ellipsis on the transverse diameter, cuts out the jack-ribs as marked *a—b*, *c—d*, *e—f*, *g—h* on the centre *c* in the plan *B*, and so on.

Fig. D is the plan of an arch or groin-ceiling, whose angle-ribs are drawn by the trammel, the same as the body-range in *Fig. B*; and they must be fixed up in their proper places, over the base lines *a—b* and *c—d*, then draw the two ribs *e, f*; then divide the plan for the places where they are to stand as 1 2 3 4 5 6 from the base lines 1 2 3 4 5 6; draw lines to the ribs 2—2, 3—3, 4—4; then to the rib *e* draw 1—1, 4—4, 5—5 which will give the length of the jack-ribs to be cut, to fix between the hips, which will complete the groin ceiling. [This method will do for any brick or stone groin or groin-ceiling.]



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P L A T E X X I .

Shews the Method of making Centres for Arches, Vaults, Ceilings, &c.

FIG. *A* and *B* are plans to be arched or groined with brick or stone, *b, b*, the centres for the body-range which is to be set on quarters or temporary plates for that purpose, which is to stand close to the piers as represented by the line 1—2 on the plan: *c, c*, are the ribs to cut the jack-rafters or ribs out of as marked on the centre, when the body-range *b, b*, is set and boarded, then the centres *c, c*, are to be cut as marked by the lines 1—2, 3—4, 5—6, and the whole ribs *b b*, to stand on the recess between the piers; then board them.

Now, to find the mitre-cut for the boarding, take the girt of the centre *c* and stretch it out as *s t* or *u w* and *x y*; then draw the lines *a—b*, *c—d*, *e—f*, *g—h*, *i—k*, *l—m*, and so on to *t—u*, and the space between these lines will represent the cover or boarding of the groin, whose mitre-cut is represented by the black lines drawn from *o* to *p*, and from *n* to *q*, when the boarding is cut as the lines direct; fixed on the centres they will make the angles of the groin complete.

Fig. B the body-range is an ellipsis on the transverse diameter, cuts out the jack-ribs as marked *a—b*, *c—d*, *e—f*, *g—h* on the centre *c* in the plan *B*, and so on.

Fig. D is the plan of an arch or groin-ceiling, whose angle-ribs are drawn by the trammel, the same as the body-range in *Fig. B*; and they must be fixed up in their proper places, over the base lines *a—b* and *c—d*, then draw the two ribs *e, f*; then divide the plan for the places where they are to stand as 1 2 3 4 5 6 from the base lines 1 2 3 4 5 6; draw lines to the ribs 2—2, 3—3, 4—4; then to the rib *e* draw 1—1, 4—4, 5—5 which will give the length of the jack-ribs to be cut, to fix between the hips, which will complete the groin ceiling. This method will do for any brick or stone groin or groin-ceiling.

P L A T E XXII.

FIG. A. is the plan of an octagon to be domed, whose covering must be cut as *Fig. 1*. *Fig. 2* is the dome, whose arch-line *ab* must be divided into a number of equal parts, as here into ten, and drop dotted lines to the plan as, 2-2, 3-3, 4-4, 5-5, 6-6, 7-7, and so on; then take the parts from the plan 2-1, 3-2, 4-3, 5-4, 6-5, 7-6. Set on *Fig. 1*, the arch stretched out, as 2-1, 3-2, 4-3, 5-4, 6-5, 7-6, and draw the arch-lines 2, 0, 2, through those points, this will give the edge of the covering for board, lead, and slate; which was to be done.

Fig. 3 is the plan of an ogee roof octagon, whose curve-line is to be divided into ten equal parts more or less at pleasure; drop dotted lines to the plan *Fig. A* as before; take the parts from the plan 1, 2, 3, 4, 5, 6, and so on as before, and transfer them to *Fig. 2*, the rafter stretched out, and that will be the covering, boarding, lead or slate.

Fig. B is a circular plan for a dome, whose rib or rafter is one fourth part of the plan as 1-2, *Fig. 3*; the outlines are the cover for one fourth part of the two inside lines; the cover for one eighth part of the rib or rafter 1, 2 is divided into six equal parts, or it may be more at pleasure; and those parts drop to the base-line 2-3; and set one foot of the compasses at 3, and turn the parts to 1-1, 2-2, 3-3, 4-4, and so on; then transfer those parts to the rib stretched out, *Fig. 3*, and draw through those points, which will give the edge of the covering. Then, to find the cross or level point, set one foot of the compasses at 0, and draw the arch-lines 1-1, 2-2, 3-3, 4-4, and so on; those lines will be the joints of the board, which will be streight, when the cover-board is bent to the dome.

The bell-roof, *Fig. C*, and caveto-roof, *Fig. D*; the cover is found the same way as that of *Fig. A*.

The cone-roof, *Fig. E* is drawn from the diameter 1-2 to the point 3, or it might be shorter at pleasure: set the compasses at 3, and extend to 1, draw the arch-lines 1-2, 3-4, 5-6, and so on to the top; each part represents the width of a board, and those arch-lines will be the joints and be streight, when bent to the curve of the plan, which was to be done.

Fig. G represents a cornice to be bent in thicknesses to go round the circular plan *Fig. B*. First draw the cornice full size for practice, and draw the spring and back-line *a*; then draw the bracket *b*, and cut it to suit the cornice as you see it on the plate; make as many as you think will do to bend your thickness on, and fix them to the plan as 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and glewing the thickness on the brackets prepared, the cornice will come off to its curve and springing, which may be easily worked for use.

Fig. F is an impost or sur-base moulding to go into the concave part of *Fig. E*, to be bent to the curve and springing. To glew this moulding in thickness, make the brackets as *l*, and fix them to the curve of the plan of *Fig. E*, and glew the thickness as in *Fig. F*; the moulding will come off to the curve and springing. By this method any circular moulding may be made to its springing; and supposing there was required a ground or dado under the sur-base, *Fig. E*; to prepare the said ground or dado, glew it up streight as usual, and plain it smooth; then groove it on the back; let the grooves and space be equal; groove it down to the thickness of a veneer, then screw it down to a templet fast to its proper curve, and glew in the back-slips; when dry take it up, and the work will be complete.



Fig. C.

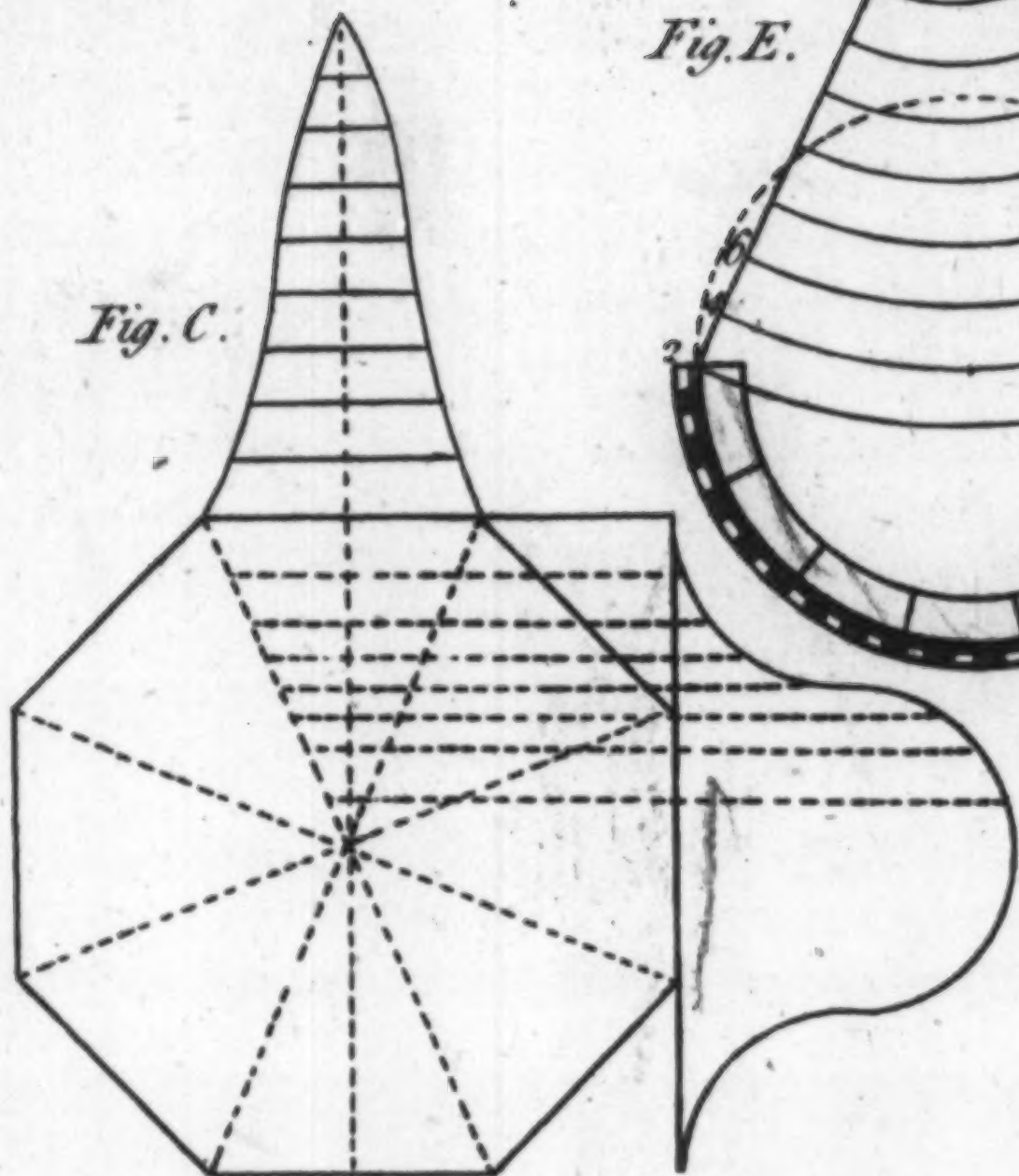


Fig. E.

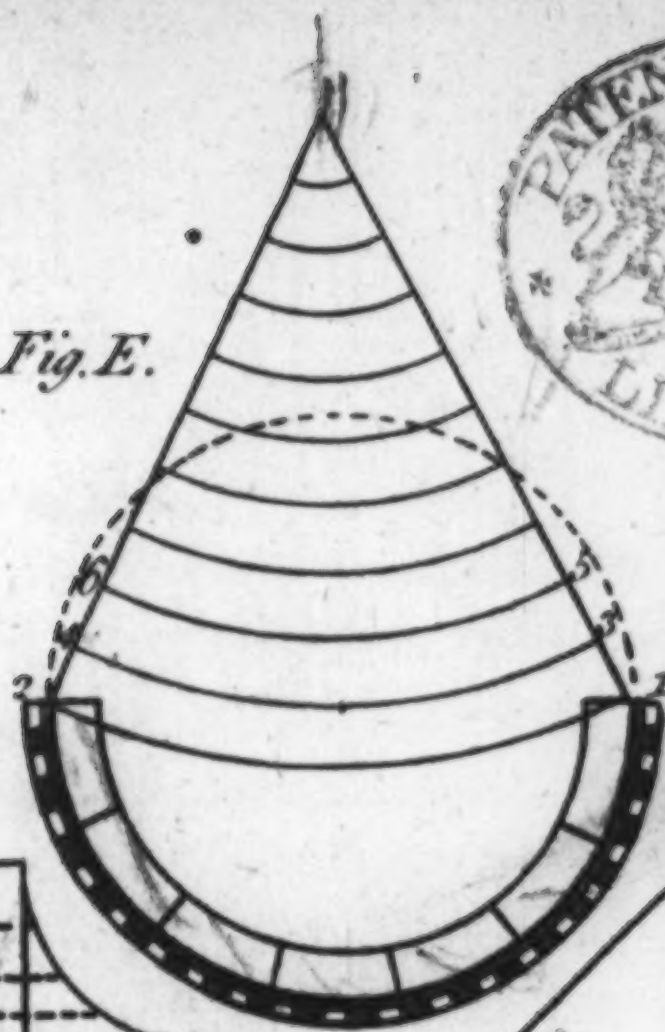


Fig. F.

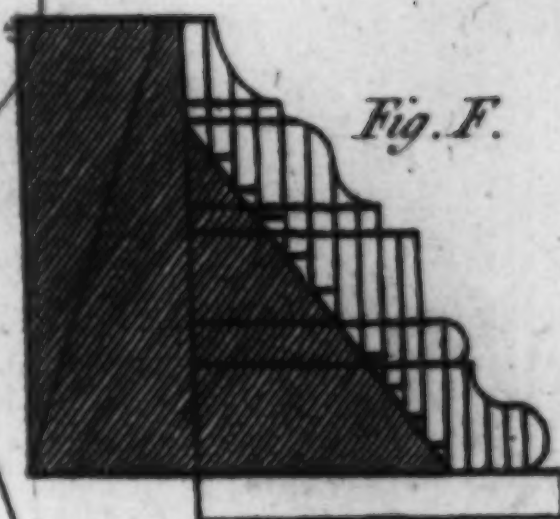


Fig. D.

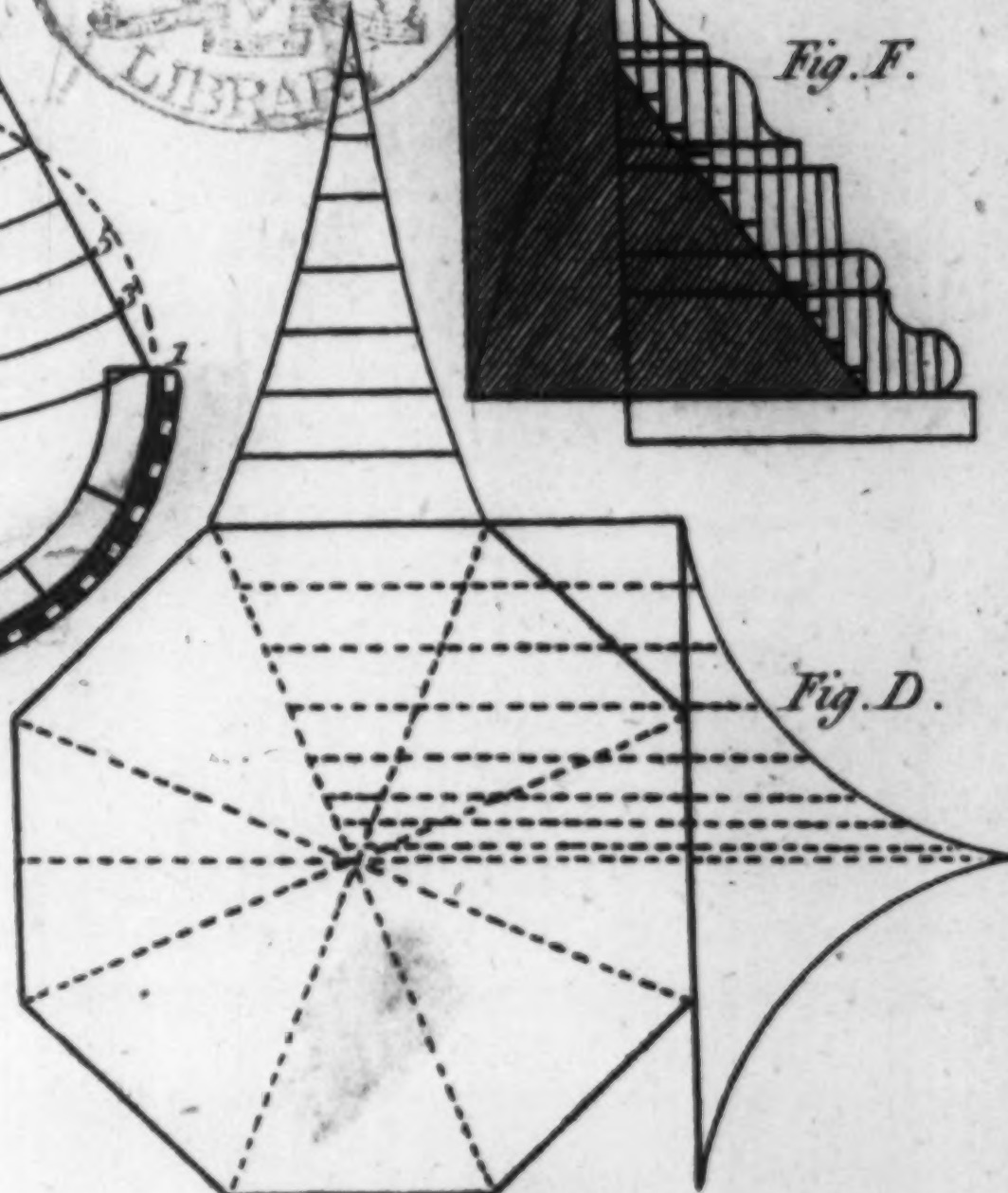


Fig. 1.

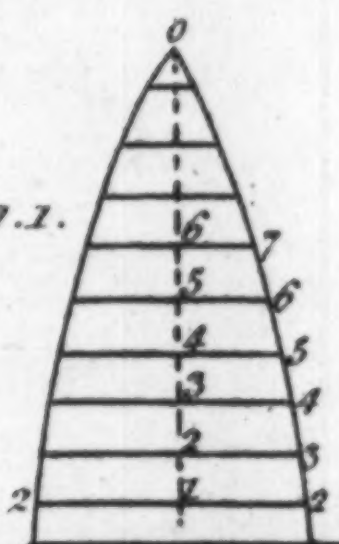


Fig. 2.

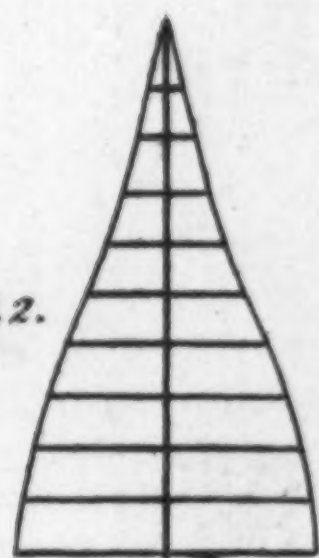


Fig. 6.

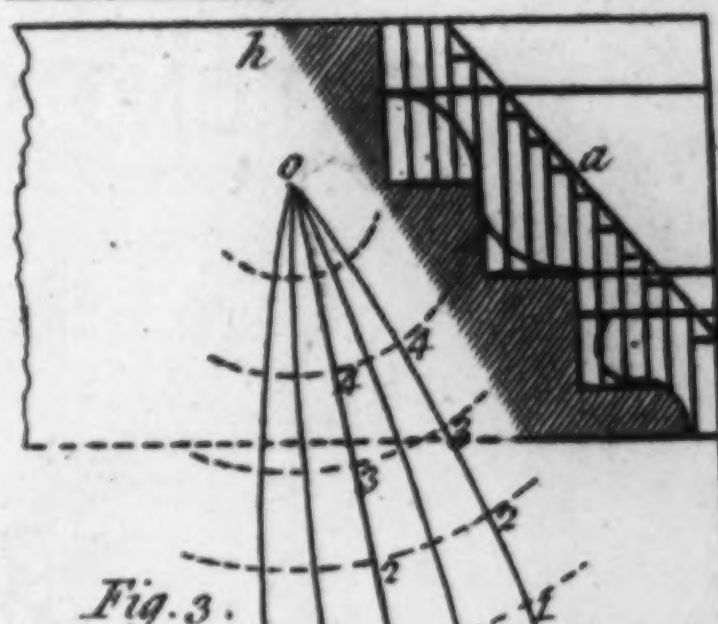


Fig. 3.

Fig. B.

Fig. A.

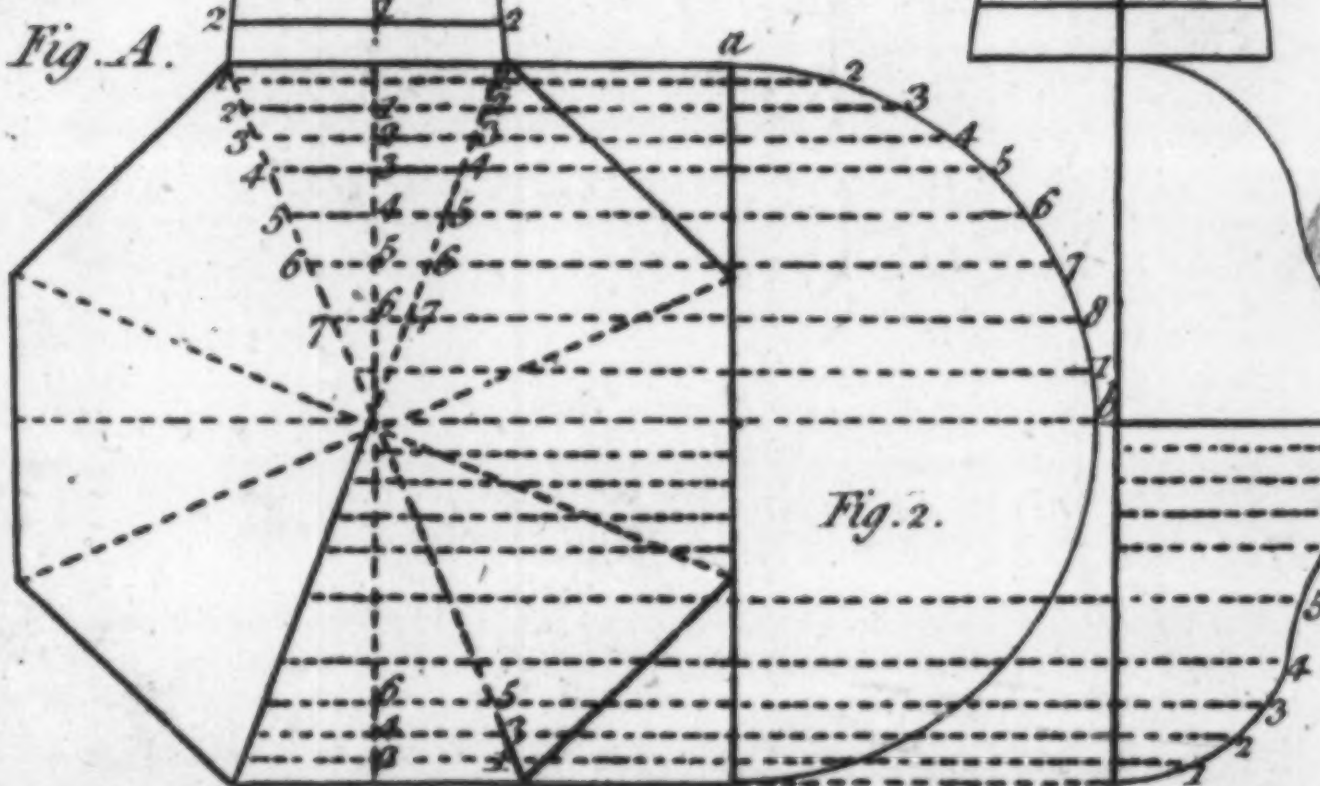
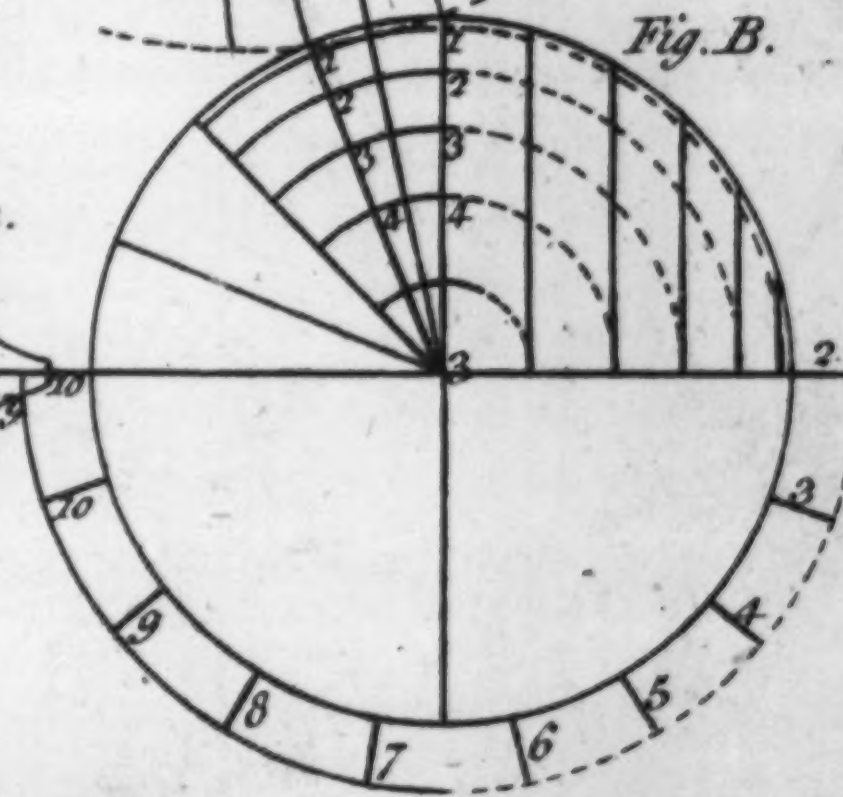


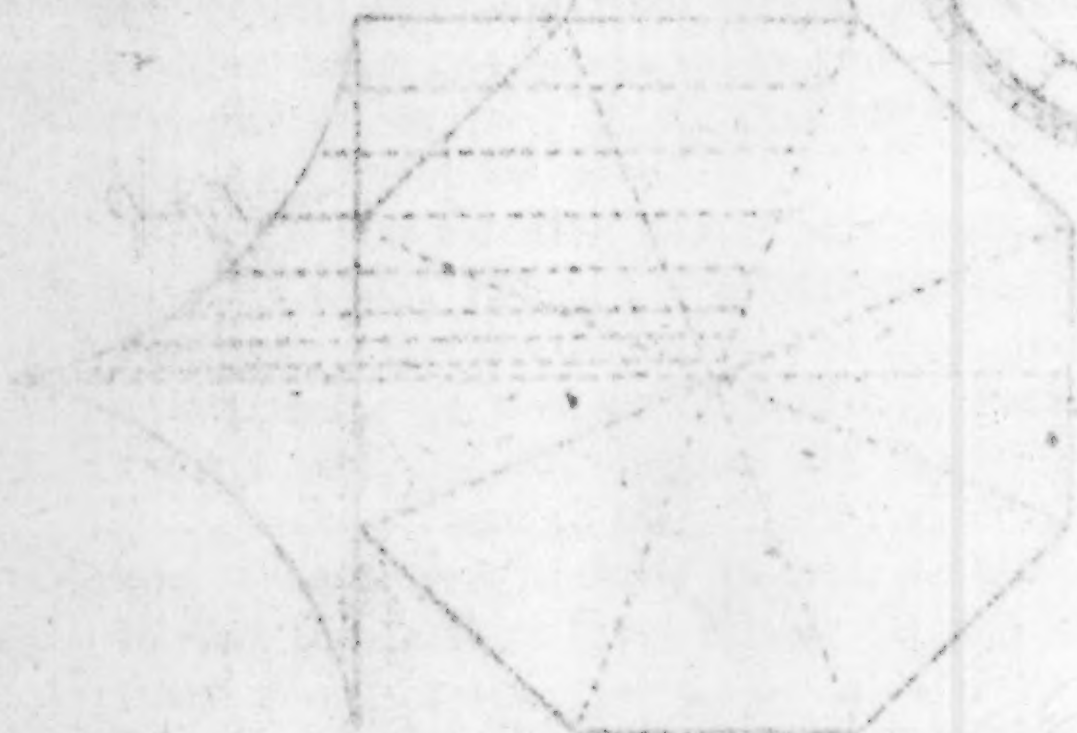
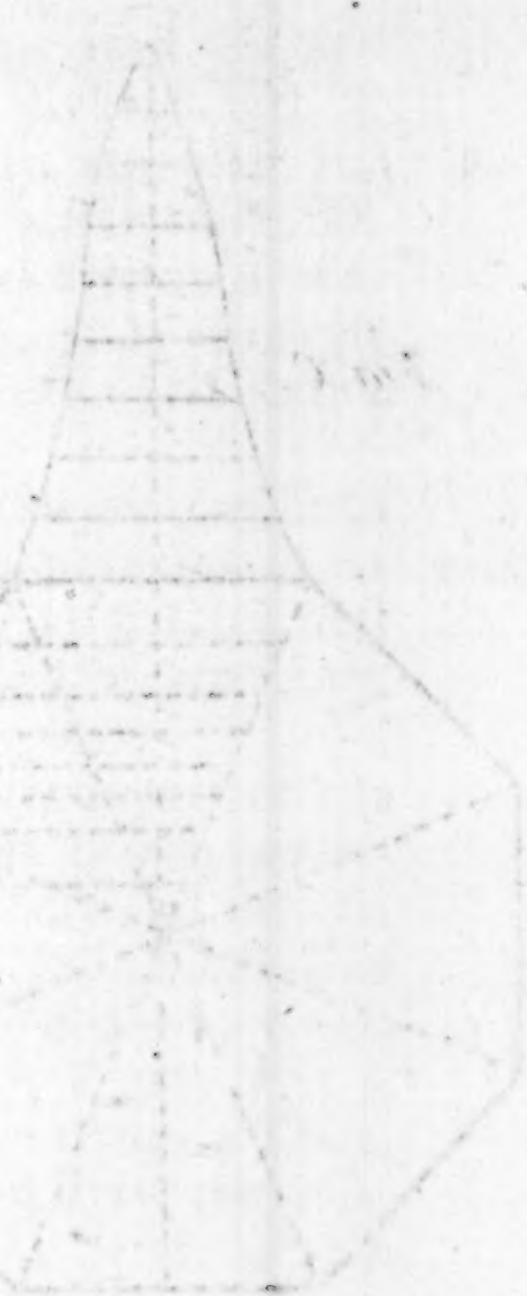
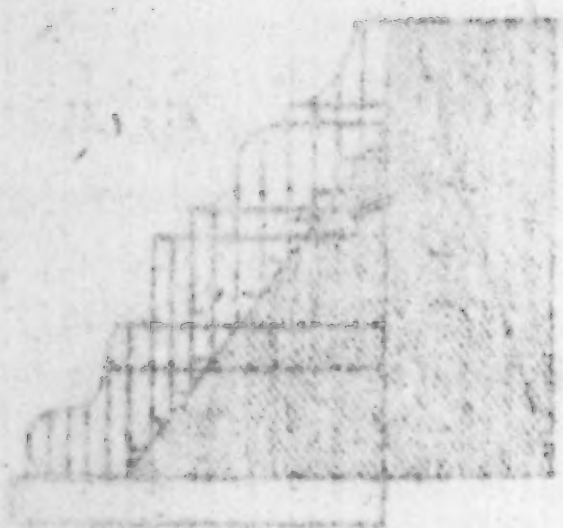
Fig. 2.

Fig. 3.

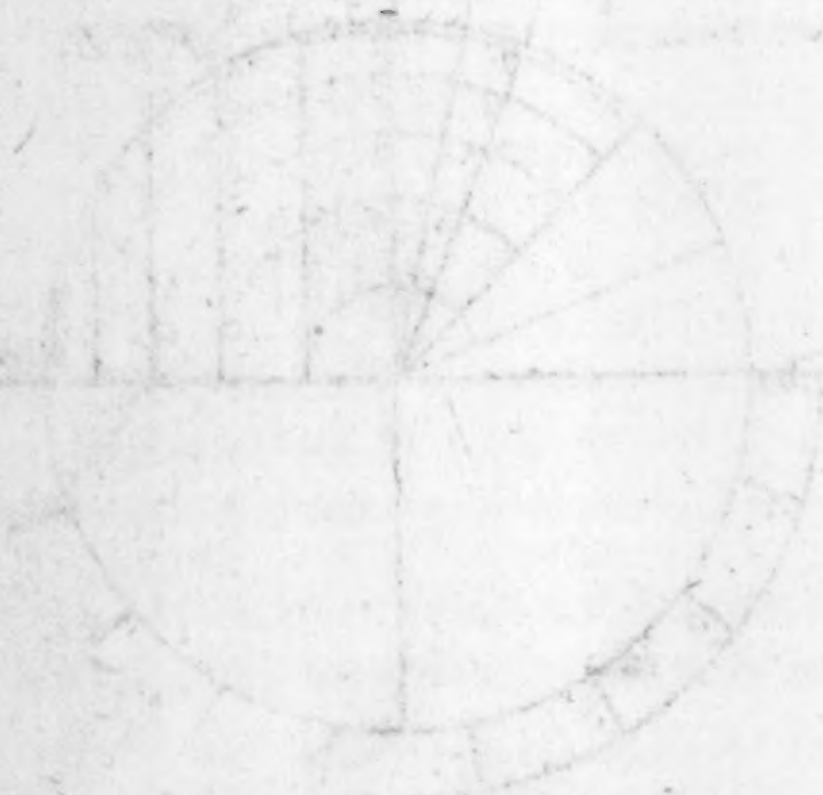


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Fig. A.



Fig. C.

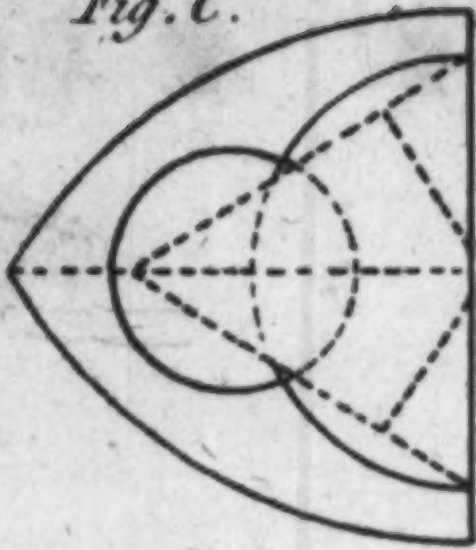


Fig. K.

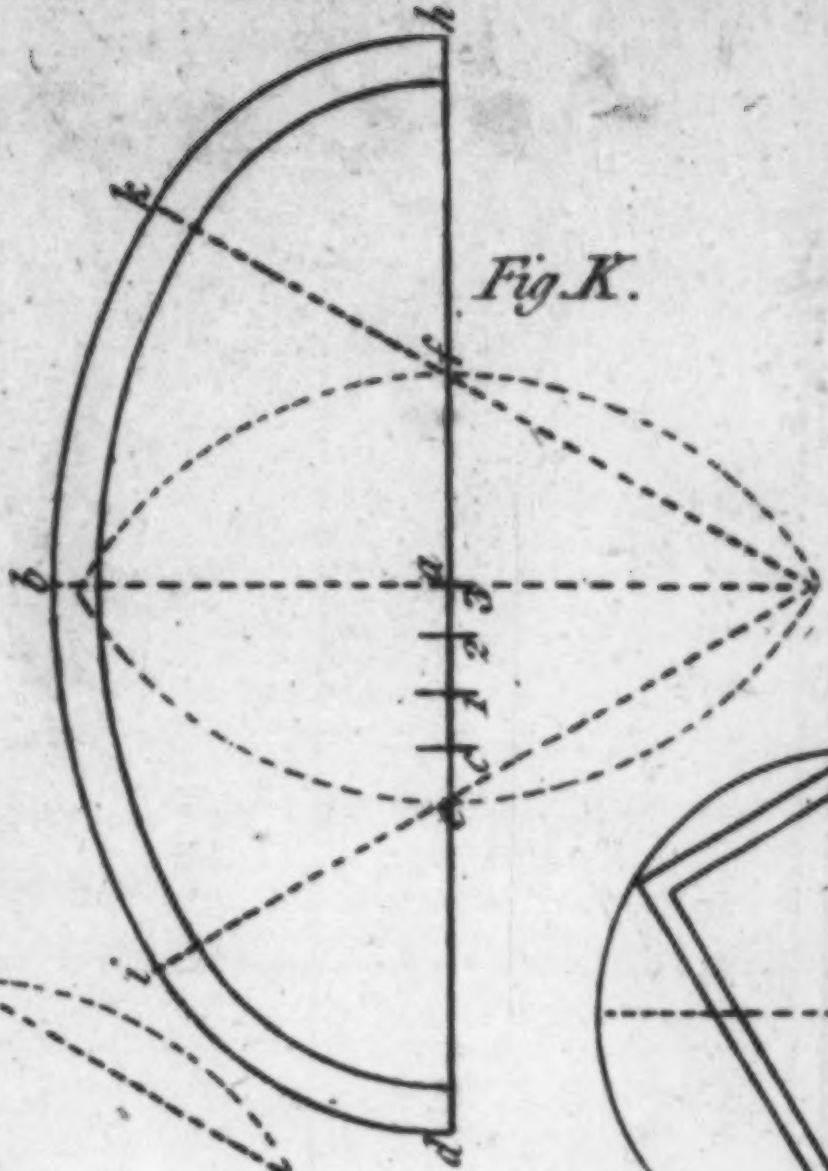


Fig. F.

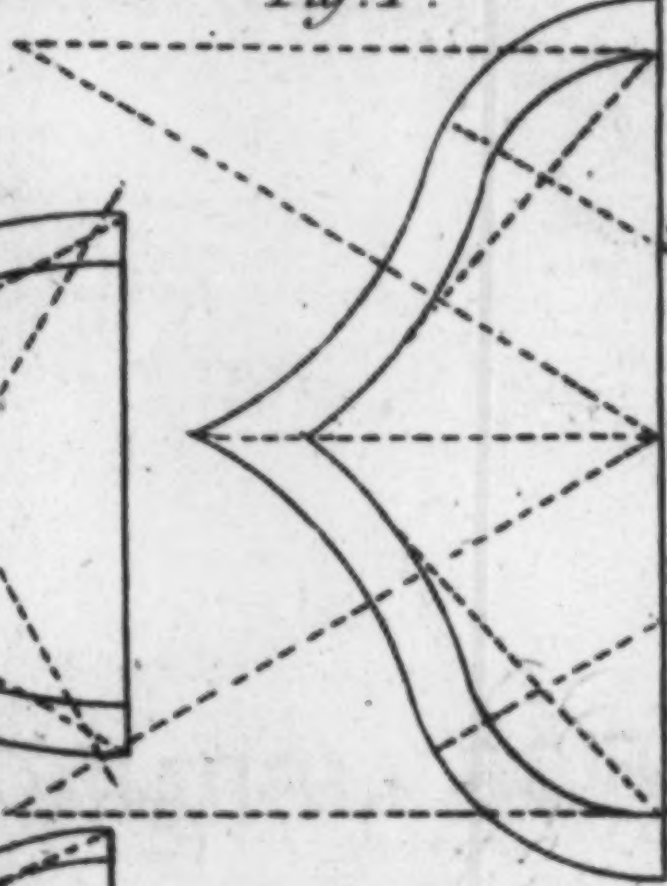


Fig. L.



Fig. B.

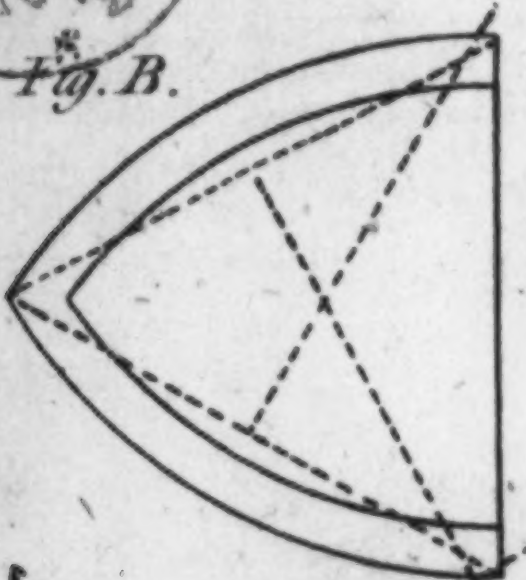


Fig. I.

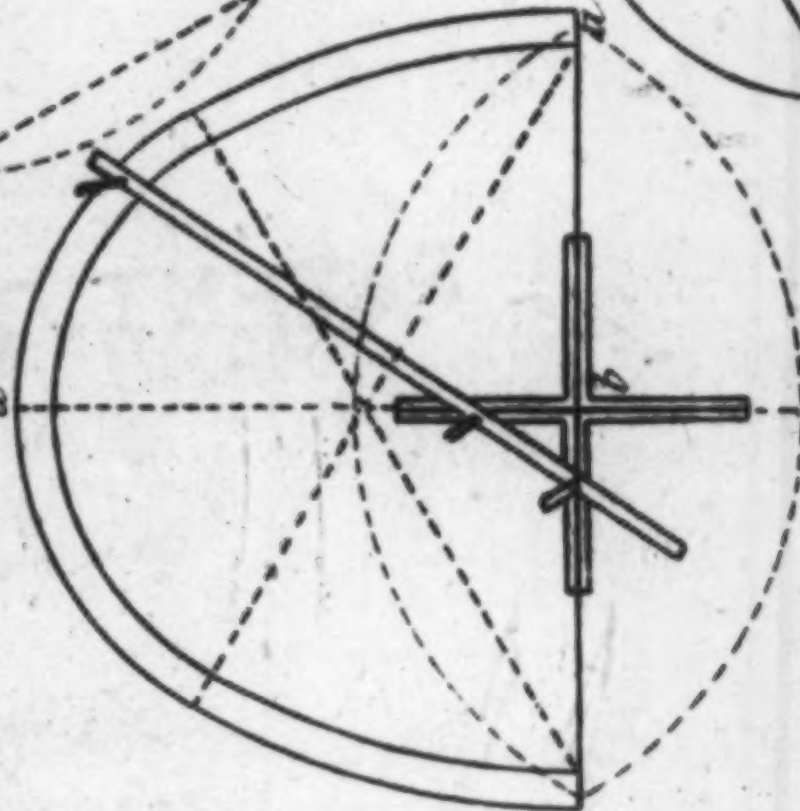


Fig. D.

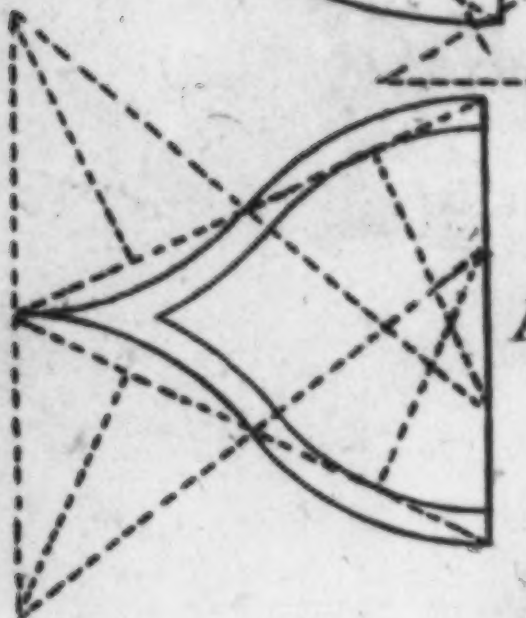


Fig. E.

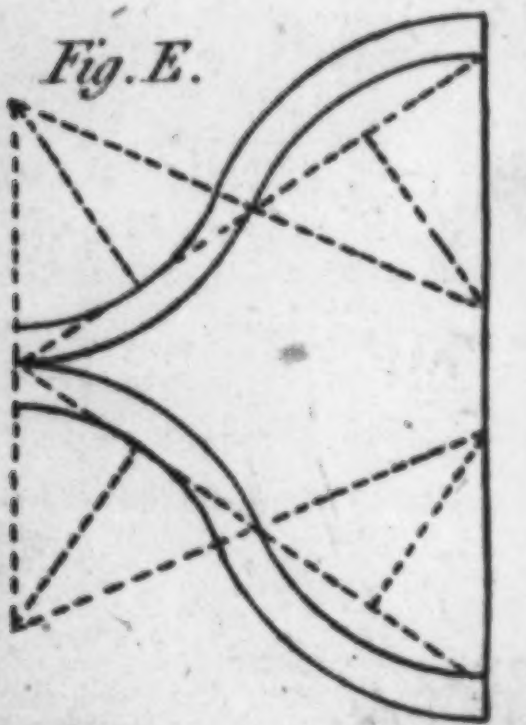


Fig. G.



Fig. H.



W. Pain del.

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P L A T E X X I I I .

Shews the Manner of drawing Gothic Arches and Ellipses, and making Centres for the same.

FIGURES *ABC* are Oxey Gothic arches; *DEF* and *G* hair-lip Gothic arches; *I* an ellipsis on the conjugate diameter; *K* an ellipsis on the transverse diameter.

The practical way of drawing the ellipsis is the trammel as shewn in *Fig. I*, by making a cross at right angles as *b*, and a rod as *a b d*; make two heads, mortice them, and put them on the rod, the same way as a gage-head, and fasten them with a wedge and a point or pencil at *a*; then fix the one head at *b*, half the conjugate diameter *a b*, and the other head at *d* half the transverse diameter *a d*, and put them in the groove, and move the rod round with the pins in the groove, the point or pencil at *a* will describe the ellipsis.

Fig. H is a segment of a circle; *Fig. L* a semi-circle with a square to a flute or neach to know if they are true.

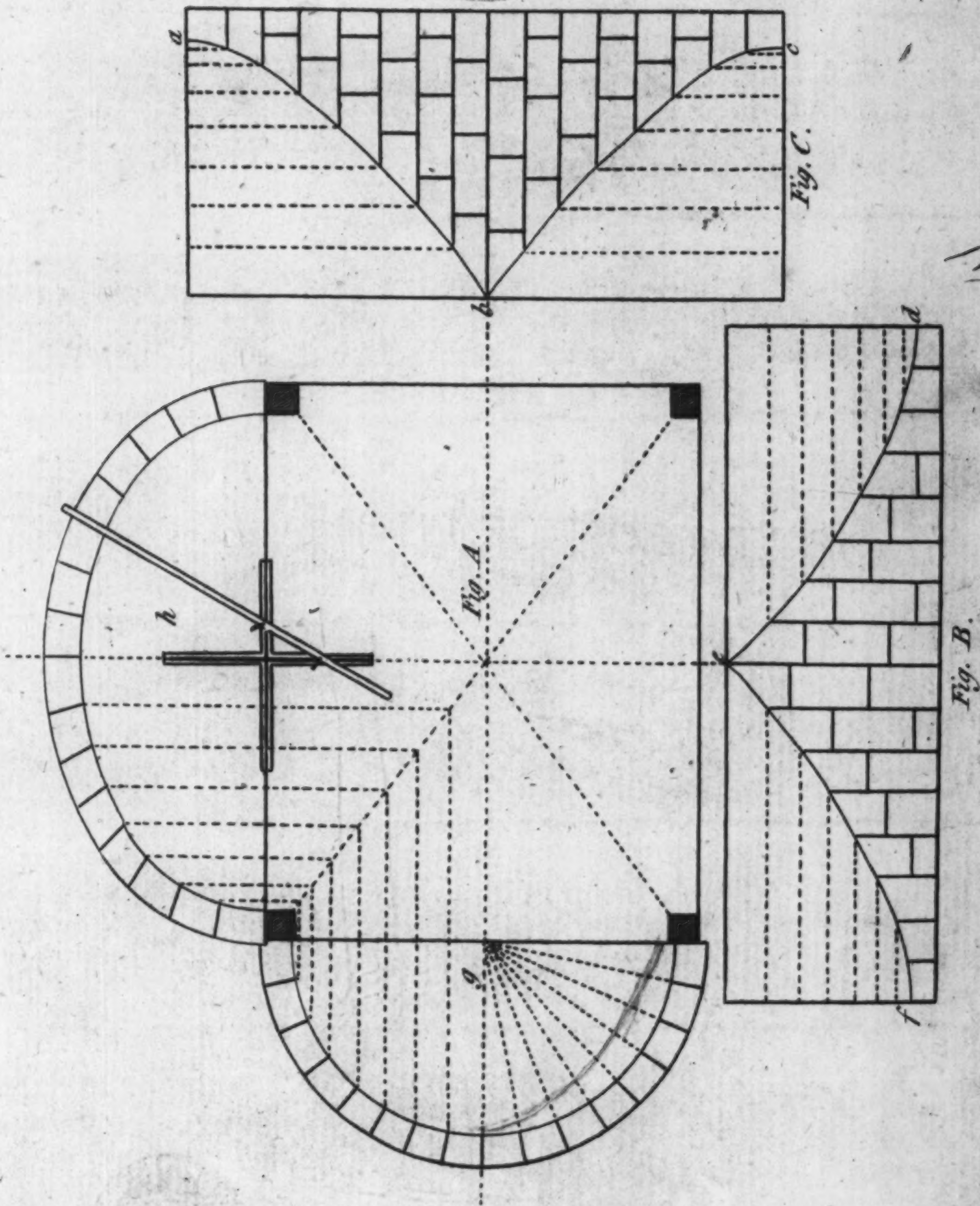
PLATE XXIV.

Represents a Stone-Ceiling or Groin.

FIG. *A* is the plan to be groined, *g* the body-range, *b* the jacks on the sommering of the joints, those in *b* are given by the trammel-rod; those in *g* tend to the centre. Great care must be taken that the joints have their true sommering, otherwise the arch will not be sound.

Fig. B represents the stones of the arch *b* stretched out.

Fig. C the stones of the arch *g* stretched out. If moulds are made of thin stuff, to the width of the courses of stone, and the ends cut as the lines curving *abc*, *def*, that will be a mould for the mason to cut his stone by, which will exactly fit the centre, and make the angles streight, and the work complete.



h

W. Paine del.

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